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IN ALL THEIR DEPARTMENTS.

BY A COMMITTEE OF PRACTICAL SURVEYORS, ENGINEERS, AND ARCHITECTS, OF MUCH EXPERIENCE AND IN ACTIVE EMPLOYMENT.

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STABILITY AND BEAUTY OF SLOPES IN EXCAVATIONS AND EMBANKMENTS.

THE grand distinction between a rude people and a refined, is, that the former seek to accomplish their purposes simply for animal gratification, without the slightest regard to elegance or grace; and that the latter so contrive every thing useful as that it is at the same time ornamental, and adapt every thing ornamental in such a manner as that it has an apparent use. In different regions, or different ages, where one people is very rude and another highly refined, this characteristic difference is broad and general; and when rude men first begin to collect or provide themselves with ornaments, those ornaments, chiefly personal ones, have more of incumbrance than of any kind of utility in them. The pieces of bone and reed which savages wear in the septum of the nose, in the ears, or in other parts, the necklaces of the teeth of victims killed in battle or of animals obtained in the chase, and the beads and trinkets whereof men at the bottom of the human scale are so fond, all belong to this class of useless incumbrances, and prove clearly that the very first rudiments of taste are unknown among the people who set the highest value upon things of this description. When, however, the first step towards civilization is taken, and the savage no more prizes the bead or other glittering bauble, but stipulates for a nail in return for a portion of his fruit, his venison, or his fish, it shows that a better spirit has begun to operate, and that those poor children — of intellect, usefulness, and ornament — are born and alive, however infantine their condition may be.

Upon all new subjects, the majority of mankind are very much in the condition of the savage; and as it is necessity that gives the first impulse the desire of removing a pain or supplying a want — which precedes the gratification of an intellectual desire, or the possession of something upon which the mind can dwell with delight, simple utility invariably takes the lead in every improvement. So very general is this precedence of necessity, or simple usefulness, to ornament, that it has become a standard phrase, and, "Necessity is the mother of invention," is an expression which we hear every day. Still, however, the mere satisfying of the necessity of any case, whatever that case may be, indicates a very low stage of human society, — few enjoyments, except those which are purely animal, and consequently but little prospect of advancement towards any thing great; and before the minds of men can be so excited as to make them run what deserves the name of a career of real usefulness and enjoyment, the feeling of elegance must be blended with the sense of necessity; and beauty, in some of its forms, must stand so nearly on a level with utility that the subject, whatever it may be, may appear useful because it is beautiful, and beautiful because it is useful. The judicious union of these is the real principle which leads mankind to greatness and true happiness in every sense of the word; and, therefore, it ought to be strictly attended to by every planner and executor of works which are to be seen by the public, and more especially of works which are public in their own nature. The more permanent and the more generally useful that such works are, the more imperious is the claim that they shall at the same time be ornamental; and so admirably is the whole system of substance and form adapted to human use and art, that that which is most beautiful is always most useful, and *vice versa*.

But though no human being, having the least pretension to taste or the least feeling to congruity, can avoid being impressed, and delightfully impressed, by this harmonious combination, when it is contrived and worked out by a man of the requisite talent, yet it is of all human endeavours the most difficult in the accomplishment; and those who can bring it about in the proper manner are but a few, even among the professional men from whom such results are in all cases desirable. In consequence of this, a door is set wide open for a host of copyists, who, as all copyists are apt to do, mangle what they pilfer, so that one seldom surveys a succession of great works, or buildings professing to be fine, without feeling the force of the exclamation of the Satirist— "*O imitatores, servum pecus!*"

The most striking, if not the most incongruous, of the compilations of these imitators, are to be found in the more expensive street-buildings and the modern churches of our great towns. This is not, however, a department of the subject upon which we purpose to enter at any considerable length in the mean time, because it is worthy of a separate paper, and involves a general principle which stands in need of elucidation. We may mention, however, that the general fault of the street-buildings consists in sticking them over with fragments of ancient architecture which have no perceptible use; and which cannot, therefore, in the judgment of reason, be regarded as in any way ornamental. On the contrary, they are excrescenses — blemishes, not beauties; and the impression which they make upon the mind of an intelligent spectator is, that the proprietors of such houses have had more money than they could command taste in expending. For example, we meet with a plain brick house, which would not stand a week but for the wooden beams with which it is bonded together; and yet this same house is stuck over with columns or pilasters, as though the house itself were, like Bajazet, exhibited in a prison-cage; and all the ornamental portions, — the volutes, the acanthus leaves, and the other filagree garnish, seem stuck on for the express purpose of conserving as much of the dust-smoke as possible, so that if the inmates should, by opening the window, contrive to get the smoke to ascend the ill-constructed chimney, the air blowing in at the said window should prevent them from lacking that atmospheric pickle which, though apparently favourable to health, is not so to cleanliness.

The modern churches, even the majority of those which are called Gothic, but which are generally speaking mere counterfeits of that style vamped up in stucco, the case is still worse. These stucco fabrics, or pseudo-Gothic, as they may be called, are of comparatively modern date; that is, none of them were built for many years after the abolition of the monastic orders by Henry VIII., and the demolition of the abbeys by those courtiers to

whom that monarch sold or gifted a portion of the spoil. In as far as the monarch and his courtiers were concerned, we have no opinion to offer; for there is no consanguinity between the sciences and arts, in whose cause we are volunteers, and political actions or opinions of any kind; but we must say that, in as far as architecture was concerned—more especially the architecture of churches, the Reformation is the epoch from which we may date a most striking and very extraordinary decline in the craft and mystery of church-building. Some time elapsed before the decline became grossly palpable; and those who pretended to taste appear to have been universally bitten by the mania that every thing of Greek or Roman model was tasteful and appropriate, and that all which was not Grecian or Roman was mean and vulgar.

It is probably not greatly to be wondered at, that, from the feeling at the time, the models of monastic chapels should have been disliked in the erection of new churches; but it strikes one as somewhat incongruous, that the substitute adopted should have been the model of a heathen temple; a structure equally incongruous with the Christian religion and the climate of Britain. Of these temple-churches, the best involve absurdities, as the original model has neither tower nor steeple; and one feels that all is not right, when a stately and ponderous dome, like that of St. Paul's, with its galleries, and external walls, columns, and ornaments, of stone, has to be supported by an internal cone of bricks and timber. In such a structure there is no congruity, for, however laboured it may be in its ornaments, those ornaments do not impress one with the idea that they are of the smallest use; and the very notion that the model is a heathen temple destroys the moral feeling which ought always to be associated with the sight of a Christian church.

It may be said that all this has nothing to do with the Stability and Beauty of Slopes and Embankments. But, as an illustration, it is much more apt than might at first be supposed; and the stubborn adherence for ages to one incongruous kind of ornament is too good a ground for supposing that the same incongruity will be perpetuated in other cases. At present, a railway, excepting perchance a bit of architecture at the terminus, which after all is an appendage to the railway and not part of it, may be said to be not only without ornament, but as ugly as a public work can possibly be made. The object seems all along to have been to execute the requisite excavations and embankments at the least possible expense both of ground, and of the transfer of materials from the one to the other; and, when one looks at a deep cutting and a high embankment, one cannot help feeling with Paddy, that "they are both so ugly that each of them is uglier than the other one." We are not now speaking of too little slope, which is almost invariably given to the loose and spongy soils, especially the clays and marls, which are so absorbent of water. This is a species of blunder which in some instances will require more than double the cost that would have made the work perfect at first; and it is not very commendable to the ingenuity of the present day to see the cross gulleys, intersecting each other like a trellis-work, and the other contrivances which are resorted to in order to prevent the action of the weather from cutting and destroying slopes, which ought at any rate to have been waterproof. This, no doubt, in part arises from canal-cutting being the chief description of excavation, on a large scale, previous to the construction of these same railways. Now the canal admits of more numerous flexures than would be quite convenient on the railway, at least with carriages of the present construction; and, therefore, the railway lies proportionately deeper in the earth, and consequently needs more both of cutting and embanking.

It is not however the absolute angle of the slope with which we are concerned in the mean time, so much as the form of the escarpment which it presents to the weather. The general form of this is a simple inclined plane, throughout the whole length of the cutting, or the embankment as it may be; and this, while it is the most monotonous and unsightly form that could be given to it, is perhaps the one of least stability as against the weather; and, therefore, although it may be the least costly in the first cutting, the after-labour of keeping it in repair probably renders it by far the most expensive in the end; for, any one will readily understand that, even a yearly repair after the trying season upon such works, will in a very short time mount up to as much as the first cost; and, therefore, in a public work of great utility, the first duty of the engineer is to avoid this protracted expense, by taking care that his work shall have that first and greatest essential—stability of endurance. In illustration of this fact, we may mention Blackfriars Bridge and the New London Bridge, as structures with which every inhabitant and visitant of the metropolis must be familiar. Blackfriars, somewhat tawdry in its merely architectural ornaments, is sadly deficient as a piece of masonry. The stone of which it was originally built is far too tender for a work of such magnitude; and many of the stones have been laid on the wrong bed, and the whole so loosely put together, that one is led to suppose there was equal disregard of the kind of mortar employed. In consequence of this, the repairs of Blackfriars Bridge, at least by the time the present tedious ones are completed, will have more than doubled the additional expense which would have been required to make it a substantial structure at the first. The New London Bridge may, on the other hand, be considered the *chief d'œuvre* of that species of masonry, having no superiors and very few rivals. The courses of stone there had their upper surfaces worked to a true plane after they were bedded and the mortar set; and this was continued not only in the piers, but as near to the crowns of the arches as there was room for the workmen. On this bridge too there is no trifling and superfluous ornament; for from the low-water line on the piers to the top of the parapets, there is an expression of mass and endurance about it, which indicates that, convulsions of the earth and other casualties excepted, it will be a bridge as long as London is a city—or the Thames a river. It is true that this bridge is a recent structure in comparison with Blackfriars; but the problem, of which the solution is desirable, is not to obtain a public work which shall last a thousand years, ascertainable only at the expiry of that thousand, it is to contrive a work of such endurance, even before one stone of it is laid upon another, and indeed before the plan of it is committed to paper; and unless the engineer knows enough of the situation, the materials, the plan of the structure, and the manner of its execution, to furnish this information *a priori*, he is not sufficiently qualified for his office. The case of these bridges is not quite a parallel one with that of railway slopes, but as we have no long-tried example of such works, we must judge of them by analogy; and in this particular case our analogical appeal must be to the grand and primary instructor of man in all science—Nature.

To that, an appeal rightly made is never made in vain; and in this particular case it is an appeal to mere surfaces, which are palpable to the observation of any child. One has only to walk over the undulated surfaces of such strata as those which give way most

in railway embankments—and such strata have very generally undulated surfaces;—one has only to walk over these, and to take note whether in them nature presents any thing like the dull extent of inclined plane which we find in a railway slope. Such planes, or at all events approximations to them, may be found in the escarpments of heights of more solid strata, especially in the chalk, where it crops out upon the strata below, and the marginal part has been tilted by the elevation of those strata, or the depression of the central part of the chalk basin. When, however, the surface which we examine consists of quicksand, loose gravel, marl, clay, or any other material which is unstable in slopes, we never by any chance meet with a continuous inclined plane, or indeed an inclined plane of any description. The section in such cases, unless where there is a tendency to instability and slipping, is invariably a sort of cima, or curve of double curvature, convex on the brow of the escarpment, concave toward the bottom, and passing by a gradual talus into the plain, or other lower ground. This is the vertical section which nature invariably makes on tender soils. And as this form of section is produced wholly by natural causes—those very causes against which the excavating engineer has to guard—is it not as obvious as the sun at noon-day that the elements must be constantly at work against the unnatural form of his inclined planes, whatever may be the degree of their inclination, and labouring, by every winter and every storm, to bring his violation to the form of the natural curve? This section of escarpment is not only the curve of stability in tender strata, for it is also the curve of beauty; and the reason why a railway appears so unseemly a "gash upon earth" is the dull straight lines of its slopes.

There is an additional matter necessary, in order to give a slope the most perfect stability and beauty; but, before we proceed to the consideration of that, it may not be improper to consider the advantages which are obtained by the simple fact of the vertical section being a cima. We say nothing of the angular obliquity of the general inclination of this cima, because that must depend upon the nature of the soil, and can be known only by personal observation. We may mention, however, that an extended slope which remains firm is obtained at a less actual waste of surface than a steeper inclined plane, which is always giving way; inasmuch as the former may be grazed or cultivated, whereas the steep inclined plane can not. The following are some of the advantages of the cima:—In the first place, a quick-set hedge may be grown on the very top of it, because the swelling at the upper part of the curve will retain moisture at the roots; whereas, under ordinary circumstances, such a hedge will not thrive immediately on the top of an inclined plane: in the second place, the water which trickles down such a curve has its progress arrested both at the upper and the under parts, and therefore it has no such tendency to tear the surface into rents as water has when it descends an inclined plane of uniform slope: in the third place, the slopes, whether of cutting or of embankment, might, if worked to the proper curves, be taken into the adjoining fields, that is, they might appear to be parts of those fields, blending harmoniously with the rest, and thus they would become beauties instead of blemishes as the straight slopes unquestionably are: in the fourth place, the fences might be placed along the outer edges of the side drains of the railway, and not upon the top of the cutting as they are at present; and the placing of them there would be attended with many advantages, in the way both of use and of ornament. The humidity and the shelter, together, would make hedge rows grow with great vigour; and, on very many soils, the Dutch hedge might be employed. It is stronger and neater than any other; and in a short time it becomes profitable, on account of the yearly supply of firewood obtained by trimming it. This hedge is best made of forked trees branching from the ground; and of any of the fast-growing and hardy species for which the soil may be best adapted. These are placed across each other, lozenge-wise, like a portion of trellis or basket, and with the openings of such size as may be desired. By rubbing the bark at the crossings, binding them together with bast, and claying the joints if necessary, the whole soon inosculates at the crossings, and becomes one solid continuation of living timber. The individual sticks are cut to such lengths as may be thought necessary; and they may be trained either in curves or in oblique straight lines, but the last is by much the better form. If properly planted, and of the right kind of timber, a hedge of this kind soon puts out a number of shoots, in which it expends its vegetation; these are trimmed down to spurs every year, and the hedge very speedily becomes a uniform green curtain during the summer months; and if roses, honeysuckles, and other flowering plants, are trained upon it, which can be done with very little labour, it admits of a high degree of beauty; and, notwithstanding its beauty, it is much cheaper in the end than those naked posts and rails which stand bleaching in the wind on the slopes of our ordinary railways, and of which the decay may be said to begin the very instant they are put up. Then again, in point of safety, both to the railway itself and to men or animals getting near it, this would be far superior to the other; while, in agreeableness to the eye, there would be no comparison. Such hedges might, in many instances, be placed along the tops of the curved slopes; but as this is a new position for Dutch hedges, the trees best suited to the different soils and situations would require to be determined by experiment. The same may, in part, be said of the plants, whether herbaceous or shrubby, which would suit best for giving a pleasant and permanent surface to the slopes themselves. At some future time we may offer a few observations on these subjects, and we should be glad of the assistance of any of our friends who are conversant with the best adaptation of fibrous and bulbous rooted plants to different soils and situations, and also of low and creeping ornamental shrubs for the same.

We shall now just hint at the remaining variation of form, whereby the slope would be made more nearly to resemble nature, and consequently would be rendered more durable and more beautiful. On tender slopes, that is, slopes on tender strata, the action of the elements works the escarpment into a succession of swells and hollows. The same form might, with very little additional expense, be given to the slopes of excavations and embankments; and, by this means, the rain would be thrown into the hollows, and have its action so divided that it would be unable to tear any part of the slopes. The bottoms of the hollows might be laid with drain-tiles, or otherwise secured, if necessary, and they might be planted with willows, or other shrubs. In short, were those diversities of surface judiciously formed, the slopes alluded to might be made as ornamental as they are now offensive, and that with little additional cost, but great additional durability.

ON PROPORTIONS INVOLVING CONSTANTS.

Every one who knows any thing about the very simple but very beautiful and useful doctrine of Proportion is of course aware that, when any proposed result is a stipulated quantity of work to be done, the product of the time and power, each estimated in some known unit, expresses the value or quantity of the work; as, for example—

a certain labour to be done requires the power of a certain number of men or of horses, for a certain number of days or hours, and the product of these numbers expresses the value of the work in the number of days or hours of a single man, or horse, necessary for the performance of it. When the number expressing the power and that expressing the time are equal to each other, the effect is numerically the greatest possible. Thus, for instance, 12 men in 12 days do more work than 11 men in 13 days; these, again, more than 10 men in 14 days; these more than 9 men in 15; and so on; the effects for the numbers stated above being, respectively, 144, 143, 140, 135,—the differences being the series of the odd numbers 1, 3, 5, &c.

Hence, it is easy to understand that, if the effect is to be the same in two cases, and either the power or the time different, the time answering to any power, or the power answering to any time, may at once be found by dividing the product of the power and time, in the case where both are given, by the power or time which is given in the other case.

There is, however, one form under which this problem sometimes presents itself, which is a little puzzling to those who are not familiar with the doctrine of ratios; and as the management of it is a very easy matter, though, so far as we know, not mentioned in any of the elementary books, we may give a short explanation of it. This will be best done by putting a case:—A certain mine requires to be cleared of an influx of water, which is constant at all seasons of the year; it has been twice neglected, and allowed to fill; and, in the first instance, a power of 8 horses cleared it in 12 hours; while in the second instance, a power of 9 horses cleared it in 10 hours. It is required to know what power will keep the mine dry, and what power is requisite for simply discharging the accumulated water which fills it, without any reference to the influx?

By the conditions, a power of 8 horses for 12 hours, and a power of 9 horses for 10 hours, both empty the mine of the accumulated water and influx. The product in the first case is 96, and that in the second case is 90, the difference of which is 6, that is, 6 hours work of 1 horse power. The difference of the times of emptying is 2 hours; and as 6 hours more work is required for these 2 hours, it follows that as much water flows into the mine in 2 hours as 6 horses for 1 hour can discharge; consequently, the power required to discharge in 1 hour the water which flows in in 1 hour is that of 3 horses, or, in other words, a 3 horse power would keep the mine clear of water, on the supposition that none were accumulated.

Reviewing the steps of this analysis, we find that they involve this very simple rule: Multiply each power by its time; divide the difference of the products by the difference of the times; and the quotient will be the constant power requisite to perform the constant work.

To know the power which discharges the accumulation, subtract the constant power from each of the given powers, and the remainder in each case will be the power which discharges the accumulated quantity in the time specified in that case. Thus, in the instance which we have given, if 3 is subtracted from 8 and from 9, the remainders are 5 and 6; and as 5 answers to 12 hours in time, and 6 to 10 hours in time, and the product is in both cases 60, which shows that the powers, cleared of the constant 3, are true proportionals to their respective times; and that the pit, without taking the influx into account, can be cleared of water by 60 hours of 1 horse power, or in a single hour by a power of 60 horses, which in effect is just the same.

LONDON AND SOUTH-WESTERN RAILWAY.

WITH A STEEL PLATE FROM THE ORIGINAL DRAWINGS BY W. TITE, ESQ., F.R.S., F.G.S., PRESIDENT OF THE ARCHITECTURAL SOCIETY.

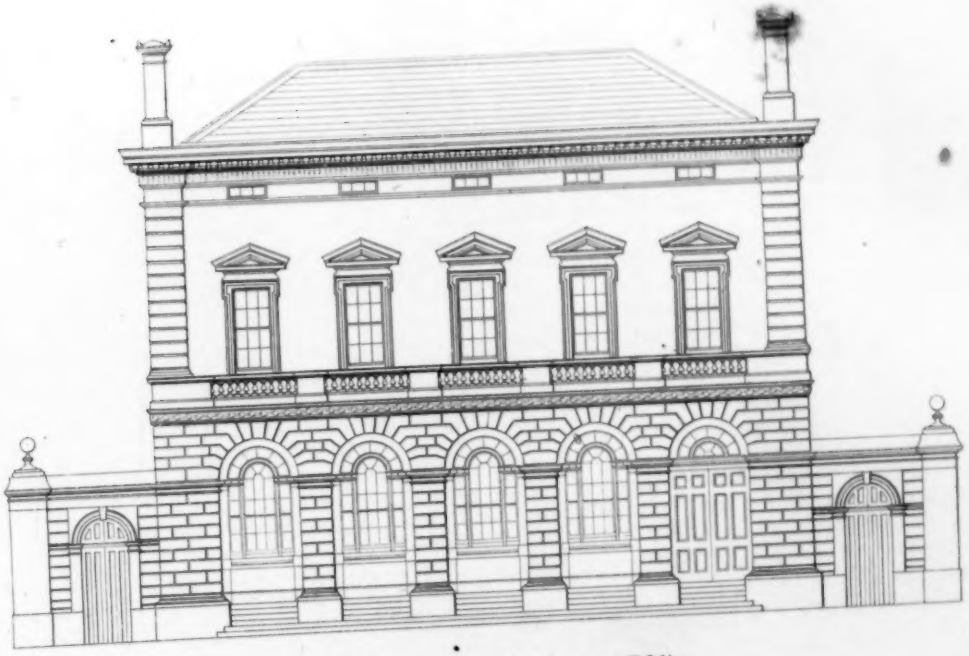
Our illustration for the present number consists of representations, reduced directly from the original drawings, of the front elevations of the terminus of this railway at Nine Elms, and of that near the projected new Docks of Southampton. In a future number, we shall give plans of the interior details, and upon that occasion we shall make what remarks appear to us to be necessary upon the architecture of these structures, and their adaptation to the purposes for which they are intended. At present, we shall content ourselves with a few general observations on the railway itself.

The South-Western Railway connects London with what may justly be considered as by far the best port and general rendezvous of shipping upon the Channel coast; and, as a road-stead, the most spacious and safe in the united kingdom. The length of the railway is nearly 77 miles; and its horizontal direction is that of a curve slightly convex to the south-east, for about the first fifteen miles from London; and a curve convex to the north-west, for the remainder of its length. The principal bend southward is about seven miles westward of the town of Basingstoke, and this is not far from the culminating point, or highest summit-level over which it passes; and here, the height above Trinity high water mark at London, is about 394½ feet. This summit is 54 miles from the London terminus, and consequently about 23 miles from the Southampton terminus. On the ascent from London, the gradients are very variable, and there are several portions on a perfect level; the steepest gradient is about 1 in 250. Until within a very short distance of Basingstoke, this portion of the railway lies upon the tertiary formation, which is very variable in its composition, consisting of London clay, marl, plastic clay, and sand and gravel of various degrees of consistency. As is frequently the case, there is a bed of plastic clay lowest in the tertiary formation, where that crops out upon the chalk; and as there happens to be the channel of a rivulet over this stratum, which requires to be passed on an embankment, the sludgy foundation, and also part of the materials of this embankment, have been both troublesome and expensive to manage. Along this part of the line there is no tunnelling; and it is fortunate that there is not much necessity for this, as the ground is by no means adapted for such an operation. A short piece of tunnel was attempted, but the tenderness of the ground made it give way.

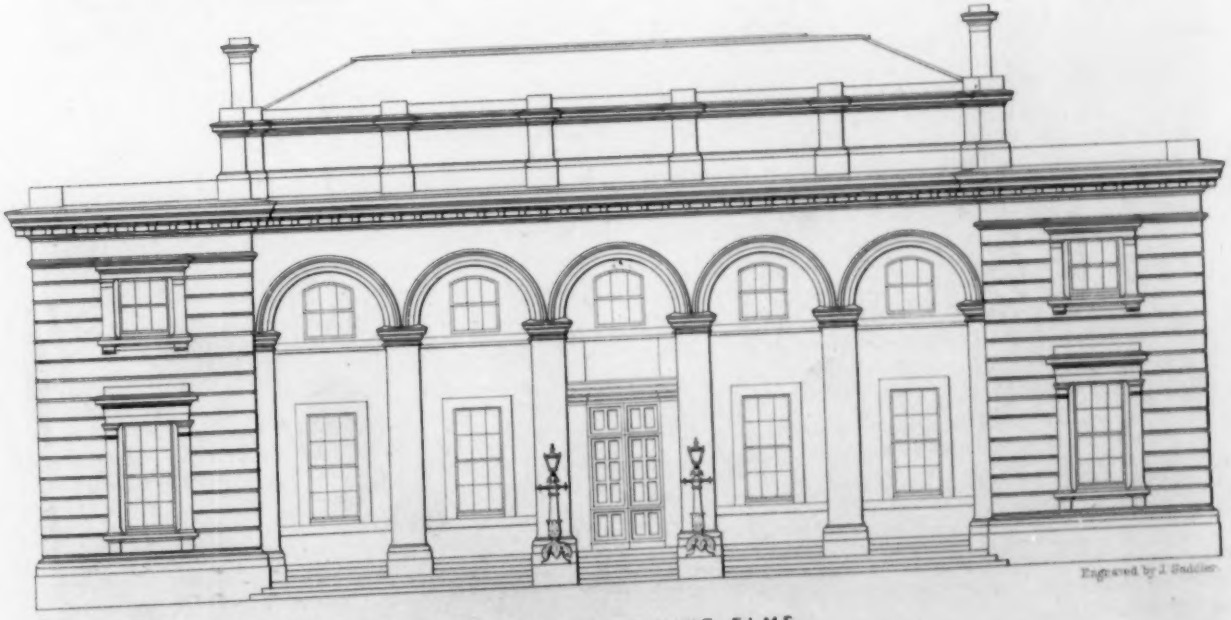
The ascent from the Southampton terminus is of course more steep upon the whole, because it is not half the length of the London one, but its gradient is much more uniform, being a rise of 1 in 250, from seven miles above Southampton, the whole way to the summit-level; and from the extremity of this uniform gradient to the terminus the slope is much smaller, and subsides into a dead level for the last two or three miles. In order to obtain the uniform gradient from the summit-level to within seven miles of Southampton, and at the same time avoid inconvenient flexures, tunnelling became necessary; but though this is an expensive operation, it is a very practicable one, inasmuch as the tunnels are driven through the undisturbed chalk strata; and the matter excavated answers well for the long and lofty embankments which are necessary in the valleys and dells between the chalk ridges. All that part of the line which is on the chalk, whether natural level, excavation, or embankment, is sound and good, and there is not the least danger of any slipping of the banks; and, in addition to this, as the excavated chalk was sufficient to bring the line down to the firm gravel

TERMINI OF THE SOUTH WESTERN RAILWAY.

W. TITE, ARCHT F.R.S. F.G.S. &c.



TERMINUS AT SOUTHAMPTON.



Engraved by J. Saddler.

TERMINUS AT NINE ELMS

London Published for the Proprietors by Grauan & Gilbert, 51 Paternoster Row, April 1, 1840.

in the lower part of the valley of the Itchen, the entire southern slope of this railway may be said to be naturally as good as could well be found. One part, where the line leaves the chalk, and gets upon the alluvial matters and peat in the valley, between Otterborne and Bishop's Stoke, was a little tender at the first, and may continue so, though not for any length of time, as it is chiefly the peat earth which is spongy, and there is no such sludgy clay as that over which the embankment at the eastern escarpment of the chalk had to be formed.

Such are the general length, position, and character, of the South-Western Railway; and having mentioned them, we may next just glance at the objects of which it is calculated to facilitate the accomplishment: and the foundation of this is the different characters of the districts in which the line terminates, together with the character of the intermediate country through which it passes. In respect of the last of these objects, the position of the line from London to Basingstoke may be left out of the question, because, though there are points of branch communication, the line passes over a desert for the greater part of this slope. Although, however, the railroad can derive little advantage, in the meantime, from this dreary wilderness, yet there is little doubt that the railroad will in time change this dreary wilderness into a fertile and populous country, for, bad as the soil is, the climate is good; and were it not that the surface is robbed for turf as fuel, the soil would soon get better. This is proved by the healthiness of the cultivated plants in those small patches which have been appropriated by squatters; and one can perceive the approach of a more wholesome and useful population, in the style of the new habitations which have been erected, or are in the course of erection, along this part of the line. The intercourse of passengers at the different stations, to and from the more fertile country to the southward, and the transit of commodities — especially live stock — will also in due time bring population and industry, and consequently wealth, along the cross roads connecting the rich districts and towns with these stations; and we had these places partly in view, in the hints we gave respecting Branch-railroads, at page 12 in our first number.

The country, from several miles eastward of Basingstoke all the way to Southampton, is much richer than that last-mentioned, but it is wholly agricultural; and therefore the chief local value of the road, besides the economy of time in travelling, is the establishment of branches, whereby a more rapid and cheap communication with the rich districts of the country might be established. One branch, namely, that from Bishop's Stoke to Gosport, a distance of sixteen or seventeen miles, is determined on; but this, though it passes through a rich country, and nearly along a level, is rather a second connection with the Channel — and a very important one it will be when established — than a mere connection with the country.

Therefore, the most important object of this line is the attractions, and differences of attraction, between its two terminations; and taking these jointly as one subject, it is easy to show that, independently of any general transit of merchandise along the whole line, this railroad is a work of no mean public importance.

The general locality of the northern terminus of this railway, being at the metropolis, where not only the principal courts, but the grand mart and first port in the empire, are situated, must always command a very great deal of up-travelling, as well as of up-transit of living or fresh provisions for the London market. Then, for more than the half of its length, the railway may be said to lie in the valley of the Thames, by far the largest and most important valley in England; and, for the greater part of this half, the line is not, on the average, more than fifteen miles from the Thames itself. Thus it offers an easy communication between the south coast and the centre of the country, and cannot fail in increasing the intercourse between these.

But the south coast has also its attractions, and these will increase the down-trade, both from London and from the central counties. The shores of the Southampton water, the Isle of Wight, and the neighbouring parts, are highly attractive, on account of the salubrity of their atmosphere, and the beauty of their scenery; and as the time necessary for passing from London to Southampton will not average more than four hours when the railway is finished, while less than an additional half hour will carry the traveller to the great naval establishment at Portsmouth; it follows as a matter of obvious consequence, that the quantity of pleasure-travelling, even within the limits of England, will be greatly augmented. Then, by the railroad, from London to Southampton direct, or to Portsmouth by the branch, is by far the best and safest passage between the metropolis and the port of Havre, so that continental tourists will, as matter of course, prefer the railway, and the steam-vessel from its terminus. Another question has been raised, namely, the substitution of Southampton and the railway for the dangerous and tedious navigation between Spithead and the Thames; but as that involves the characters of the Channel tides, and some other matters, the consideration of it will require a separate article.

BRISTOL DOCKS.

[CONTINUED FROM P. 38.]

I NEED hardly observe that, in determining the dimensions of these locks, as indeed in every other similar question, I have availed myself of the opinions of those likely to have the most local experience, as well as general knowledge, of such matters.

I have assumed 60 feet in width and 220 feet in length, as ample for this service, but not unnecessarily large; particularly if they are to be rendered available for the larger steam-ships, in the manner to which I shall hereafter refer.

The estimated cost of these proposed new locks is very large; but recent opportunities of observation upon the masonry of the existing works has satisfied me that it would not be wise to trust to any part of these, and that it would be necessary to construct the whole entirely anew, and even to incur some expenses in securing the old work during the progress of the new.

I have assumed, also, that granite should be employed in lieu of the stone of the neighbourhood, and that the bridges, machinery for working the gates, &c., should all be of a substantial and permanent character, and of the most perfect construction, such as I should certainly advise being adopted even with the view of ultimate economy; but, if the reduction of the present expense were from any circumstances more important than future economy, some considerable saving might be effected. It is to be remembered, however, that the expense, though large, would probably be spread over a period of several years. The outer entrance would be the first made, and this work would probably occupy, unless pressed, eighteen months, so that it would be nearly three years before the two would be completed.

The improvements proposed in the channel of the river do not require much observation. The advantage of removing two or three of the most projecting points has always been much felt, and, in consequence of the steam-boat trade, it is now become quite necessary that it should be attended to, the more so as it is almost unavoidably a work of time. To remove the masses of rock, and get rid of the material by a forced sale, would be a very expensive process; but I have no doubt that arrangements may be made and contracts entered into for quarrying beneficially a great part of the excavation and gradually removing the rest, by which the improvements required may be progressively effected, and at a moderate expense, probably less than I have allowed for them in my estimates. The removal of the projection at the Hotwell House I consider should be immediately

effected. It is true that this involves the destruction of the building; but neither the original cost nor the architectural character of the building ought for a moment to be considered as a justification for the existence of such a serious evil to the navigation, not only by the contraction of the channel, but even still more by the obstruction to the view from vessels passing this place.

Round Point must of course be removed; and on the opposite side, and a little below, a great improvement may be made.

Not less essential than the removal of the natural impediments is, I consider, the entire removal of the obstructions which have been allowed to be formed by the parties working the different quarries, to an extent of which I had no conception, although well acquainted with the river, until I had obtained the actual dimensions of the channel at those points. These should immediately be removed and prevented in future. I am aware that your harbour-master, Captain Robe, takes great pains to endeavour to prevent these encroachments; but I think the decisive step of removing or compelling the removal of them should be adopted.

In the plans deposited for the purpose of the proposed application to Parliament, I have included the formation of retaining walls to the towing paths at various points, in order to facilitate the removal of some large banks of mud; and also the formation of a very considerable cut nearly opposite the Powder-House. These I should not recommend as at present necessary; but it would be very desirable to secure the right of making them at a future period. They are not included in the estimates.

The extent to which these improvements must necessarily be carried, although very desirable for the trade generally, will depend mainly upon the nature and extent of the accommodation to be afforded to the steam-ships.

If these vessels are to be brought frequently into the Float, the channel must be widened and straightened to the full extent assumed in the estimates, and the principal works at Round Point must be proceeded with immediately; but, if these vessels can have sufficient accommodation below, the removal of these points may be carried on progressively, as I have before stated; and the extent to which the work shall be carried may be determined after further experience.

The question of the mode of accommodating the steam-ships does in fact influence all the other questions; and I shall now state the result of the best consideration I have been able to give to the subject.

The two first plans which I have considered, and the adoption of one of which has always appeared to be unavoidable, were, the construction of a sufficiently large entrance lock into the Float, or the formation of docks at some point lower in the river. The advantage of the latter would have been the avoiding all the difficulties of the navigation of the higher part of the river, which many consider would be dangerous for vessels of very great size.

After a careful survey of the best site for the proposed docks, and of the channel of the river above them, I have been obliged to come to the conclusion, in my own mind, that the comparative advantages are so nearly balanced that the cost would alone have determined the question. I think the advantage of concentrating the improvements and the trade on one point, and that the point where all the capital is already invested, very great; and I think that, with the proposed improvements of the river, the vessels in question might be safely navigated with tug-boats; but, on the other hand, I believe that from their immense size they would be a source of considerable inconvenience to other vessels, both in the river and in the float, and that a separate dock devoted solely to this service would be more convenient to all parties. The expense of a dock capable of holding five or six, according to the site chosen, of the largest class of steam-ships, estimated at 98,000*l.*, would not much exceed, considering that it is *additonal* dock room that is obtained, the cost of the entrance into the float, with the increased expenses necessary upon the river, amounting altogether to about 80,000*l.*; but a temporary economy might be gained by the large entrance into the float being used (when there was water enough to supply the lockage) for all steamers which might be above 45 feet; and thus the expense of the new 60 feet entrances postponed, though they would eventually be necessary, as the large lock could not be used frequently in one day on a neap tide, without a good supply of water from the Avon. The difficulty of determining between these two plans has, however, been entirely removed, and it will, I think, be quite unnecessary that I should now occupy any more time in describing the works I should recommend in the event of either of these plans being adopted, as I shall strongly urge upon your consideration the adoption of a totally different arrangement, by which I believe every immediately necessary object will be attained at a much less cost, and the accommodation may hereafter be extended and rendered as perfect as it can be desired, at a moderate additional expense.

It is fortunate that the survey and the consideration of the subject of a landing place in the Severn was proceeding at the same time as, and indeed formed part of, the general survey for the improvements of the Port; and I soon perceived the necessity of considering the two objects in conjunction with each other, and the consequent danger which might arise from their being brought forward separately. I therefore applied to the two committees upon the subject, and resolutions were passed which now enable me safely to recommend the modification of the plans in the one case to suit those of the other.

In order more fully to explain the effects of this, I will briefly state the results of my examination of King-road and the neighbourhood of the mouth of the Avon, with the view to determine the best site for a landing place. Portishead on the south of the Avon mouth, and the battery on the north, are the two points most evidently fitted for the purpose: the latter is the nearest to Bristol, but the former is most sheltered. At Portishead there is now a good road-stead, where there is at the lowest tide three and a half to four fathoms of water, with a soft bottom, and well known for being sheltered from the most prevailing winds and not exposed to the strong run of the Severn tide. If the vessels using the pier were generally to proceed afterwards up the river into docks at or near Sea Mills, the greater proximity to Bristol, the circumstance of the roads of approach being the same to the pier as to the docks, and other causes, might lead to the reconsideration of the battery north of the Avon as the site of the pier; but, if a sheltered anchorage for the vessels to remain near and about the pier be required, Portishead is undoubtedly to be preferred, and I therefore examined very carefully this part of the river. In this examination I was much assisted by the surveys in the possession of the corporation, made some years ago for a similar purpose by Mr. Comrie, under the direction of Mr. Mylne, and still more by the personal assistance of my friend, Mr. Claxton. We found the soundings shown in Mr. Comrie's charts minutely correct, and consequently no changes have taken place in the channels or banks for nearly twelve years, which is very satisfactory. From these, and our own additional soundings, it became evident that the most perfect accommodation might be afforded to the steam-ships without the necessity of their going up the river at all, except for repairs; and that, as the pier was necessary, quite independently of the question of the docks, a considerable saving would be effected in the total outlay, if, instead of the larger entrance into the Float, or the distinct docks, the accommodations at the pier could be rendered sufficient. The favourable circumstances of the locality will admit of their being rendered very perfect at a comparatively small increased cost.

A pier merely sufficient for the required object of securing a landing place at all times for the service of a line of packets, I estimate at 45,000*l.*, while, at an increased cost of only 13,000*l.*, the length of the pier may be extended to 900 feet, which would entirely shelter a very large surface of water, which is now nearly always smooth and would then be rendered completely so, and an extent of accommodation of wharf room or landing berths afforded, which would be sufficient for a very extensive steam-ship trade.

This amount of 13,000*l.* must be compared with that of 80,000*l.* for the large lock and additional widening of the river, or with the costs of the docks; for either of which it affords a substitute, and one which can always be made to adapt itself not merely to the increased number of vessels, but to any still further increase of the dimensions of the vessels using it—a very great advantage; for I ought not to conceal from you that, although assuming a width of 85 feet and a length of 350 feet for the larger locks, and which many persons may even think excessive, I consider it might be necessary to give further consideration to this point before the works were finally decided upon and commenced, as, unless some great improvement be made in the construction and arrangement of paddle-wheels, or some other mode of propelling vessels be intro-

duced, I believe they will even exceed these dimensions.—The pier becomes, therefore, a very important part of the proposed works, and I will now describe generally the nature of the construction which I should recommend.

The rise and fall of the tide at this part of the Severn is, upon spring tides, about 45 feet. To this great height must be added the depth of water required at low water, say 21 feet, and, allowing only six feet above high water mark, we have 72 feet as the height, exclusive of the foundations, to which any pier built upon the ground must be carried. The enormous expense of such a building (it would be useless if much less than 600 feet in length) of whatever materials, constructed under all the disadvantages of tide work, would alone, I think, be an insuperable objection; but, besides this, it would be difficult to make it a very convenient landing place. A fall, and still worse a rise, of 8, 9, and sometimes 10 feet per hour, alongside a fixed pier, prevents any easy arrangement of steps, or still more of any wharf for landing goods, and an average height of 22 feet 6 inches, with occasionally 45 feet of steps to mount, is a serious objection, and would destroy all the comfort of the landing for passengers. The position also of such a pier, with reference to the set of the tides, and the deposit of mud which might ensue, would be very difficult to determine, and once fixed could not be altered. These are all serious difficulties which, of course, may by expense be overcome, but which in this case it is much better to avoid. A *floating* pier is, therefore, that which I should recommend. We know that a vessel considerably larger than a first-rate ship of the line would be immoveable (as indeed the Great Western nearly is at Kingroad) in any sea that can be felt at Portishead road; and that the lee of a line of three or four first-rates moored close together would be perfectly smooth. I propose two or three vessels of 300 or 200 feet in length, built of iron, as the material cheapest and best adapted to the purpose, of 16 or 20 feet draft of water, and about 30 feet beam, moored close stem to stern, so as to form one continuous floating body. Any steam-boat or other vessel alongside will of course always be on the same level as the pier, the passengers, on disembarking, will at once be on a level platform or deck, under shelter, where the luggage or goods can also be placed, and the communication with the shore will be effected without steps. The position of such a pier can be altered at any time; it may be added to or diminished; it may even be altogether removed: and, as a great proportion of the cost is in sheet-iron, chain-cables, and anchors, and other moorings, the property is a very disposable one. Such a pier would afford stowage for almost any quantity of coals, fresh water, and general goods, which could be stowed here for embarkation.

If only 600 feet in length, it would require upwards of eight thousand tons of ballast to obtain the necessary immersion; and any convenient portion of this amount might be water, to be increased or diminished according to the stowage on board; nor need this be attended to with much accuracy, as 500 tons more or less would only make a difference of a foot in the level of the deck. A considerable revenue might be derived from this arrangement, and, what is perhaps of more importance, it would be a great accommodation to the vessels using it.

Amongst other advantages peculiar to this part of the plan,—I mean the particular construction of the pier,—is one which is by no means to be lost sight of. The whole, or nearly the whole, consist of materials, boiler-work, chain-cables, anchors, &c., peculiarly of Bristol manufacture, so that not only most of the money required for the construction of the vessels which will use it, but for that of the pier itself, will probably be expended amongst those who will provide the funds.

With respect to the position of the pier, and the point upon the shore with which it would more directly communicate, it is evident that the consequent increase of value to the land would be very great, and the surrounding property be much benefitted. I was aware that the ground west of Portishead Pill was Corporation property, and consequently that it would be desirable to improve that property which was to contribute towards the expenditure; while, at the same time, no difficulty could arise as to obtaining the ground required; but I considered that it was better to fix upon the site solely with reference to the accommodation of the shipping, and of that portion of the public which would use the pier, and as the landowners whose property is affected must be fully sensible of the great advantages to be derived by them, from the selection of their ground as the site of the proposed landing-place, and also of the fact that the corporation property might be used without any act of parliament, I considered that we might rely upon their support. Mr. James A. Gordon, who is the principal proprietor, I am bound to say, afforded me every facility, and, without committing himself, appeared to be very sensible of the importance of the measure. This pier, in its first instance probably only 600 feet in length (as it can be extended at any time), with its communication with the shore, (the mode of effecting which will be better explained when I lay before you the detailed drawings), in conjunction with the gradual and progressive improvements of the channel of the river as before described, I should recommend as the works which it is most essential should be now determined upon; the one, as immediately necessary, or the existence of which would be at all events likely to be capable of influencing very materially the future trade of the port, and that, sooner almost than it can be completed; the other, as a work of time, which ought not to be delayed; and these, with some slight modification of the gates and bridges at Cumberland Basin, to admit the steam-ships without their paddles, I consider as sufficient in lieu of the proposed entrance into the Float or the New Docks. The provision for the landing of passengers from the smaller steam-boats outside Cumberland Basin, to which I have not before alluded in this Report, is also a necessary work which ought not to be postponed, as affording the greatest relief to the entrance into the Basin, and giving that accommodation which the convenience of the public imperatively demands. These works, the cost of which would amount in the whole to about 70,000*l*., I should beg strongly to urge upon your consideration, as likely with the smallest immediate outlay to produce the most important results; and although the enlargement of the entrances at Cumberland Basin must not be lost sight of, yet the postponement of these for a year, or even two years, merely involves a corresponding delay in the advantages to be derived from them; whereas, upon the early construction of the pier or landing-place, and perhaps some temporary arrangements for admitting steam-ships without their paddles into the docks, will in all probability depend the important question whether Bristol shall be amongst the ports whence new lines of steam-ship communication, in addition to or even in competition with that one already in existence, shall be established.

This pier (or some equally effective means of landing) is admitted to be necessary. If the foreign packet trade is to be encouraged, it *must* be made; and as no line of packets will be established at a point where such accommodation does not exist, it must be made, if possible, before any other point is finally determined upon. At the present moment an opportunity does occur, as it seems to me, of placing this port, by one step, in a position to recover any loss it may have sustained in the race of competition with other ports, and of starting again in this race with at least equal, and, I believe, with superior advantages. A great change is unquestionably about to take place in the carriage of merchandise by sea; a change similar, though possibly not so striking to the senses, as that which has so suddenly been effected by railways in land carriage. To ensure the speed which the passenger traffic demands, great size in the vessels is required; in the course of a very few years we shall find Atlantic steamers desirous of taking 500 or 600 tons of cargo to make up their draft; and a trade will thus be first created by the line of passenger ships which will afterwards be a large source of profit to them, and may probably become the governing trade, but the direction of this trade will depend entirely upon that first taken by the passenger lines. All the advantages of certainty and regularity of the means of communication which are the peculiar claims of steam navigation, as well as despatch, are multiplied in proportion to the number and consequent frequency of the arrivals and departures at the same port: and thus the early establishment of one principal line of communication, if at all justified by the subsequent experience of the conveniences and facilities afforded at the port which may have been selected, will necessarily compel other parties to adopt the same point.

This trade, great as it already has become within the last few years, is in its infancy, and if prior to that great extension which is evidently about to take place, any one port can offer undoubted advantages — in spite of any prejudices which may exist, but which cannot yet have had time to take very deep root, or to lead power-

ful parties to commit themselves irretrievably by the expenditure of large capital at other points — this port cannot fail to secure to itself the establishment of many of the principal lines of steam communication. The extent of the direct and indirect beneficial consequences of such an establishment can hardly be foreseen, but the least sanguine will admit that it must be very great. The large consumption of coals and other stores, the construction and repair of vessels and machinery, the expenditure of money by passengers in their transit, the general trade induced by that (in itself very large) which is compelled to seek the port where the best and most frequent steam communication can be secured, are all sources of profit and advantage so great that the most cautious men would, I conceive, risk, and wisely so, a very large outlay and make very great exertions merely to increase their chance of securing them. Other ports are already prepared to a certain extent, or are commencing preparations for offering the necessary accommodation; the port of Bristol has proved itself well adapted, by its position and by many natural causes, for this trade; — the unprecedented regularity of departure, and I may almost say of arrival, on the days fixed, without a single exception during two seasons, and the general success of the great Western Steam-ship, unequalled by any of its rivals; — the increase of the Irish steam-boat trade, notwithstanding the impediments I have referred to,—are good practical proofs of the present natural capabilities of the port, if any were required. The approaching opening of the Great Western Railway—the connection by railway with Devonshire and the South-west of England, with Gloucestershire and the North, will render Bristol, already a central point, more accessible, from all directions, than *any port in the kingdom;* and, with the addition of the accommodation recommended, it may be placed in a position of superiority in all those conditions which are necessary for steam navigation, but *priority* of claim is equally necessary; and it is now for you to determine whether, by a comparatively easy, if prompt, effort you will place Bristol in that position, while there is yet time to command a decided preference in the establishment of such a trade, which can afterwards be easily maintained, and which must lead to an immense extension; but which, if now lost, and if the present opportunity be allowed to escape, may never be regained.

To the Committee, &c., &c. J. K. BRUNEL.

PORTER'S PATENT ANCHOR.

The long-standing objection to the anchor at present in use is its having, when in the ground, *one* arm, which is not only useless, but frequently mischievous. It is well known that the only reason for having an anchor made with two fixed arms, according to the plan of the present day, is to ensure *one* taking the ground on whichever side it may fall; and the other immediately presents a dangerous projection, which in a crowded anchorage becomes a hidden peril, frequently doing incalculable injury to ships and boats, and only found out when too late to be remedied. The patent anchor invented by Mr. Porter differs from that in common use by the arms being moveable. On reference to the engraving, it will be perceived that the arms fit into jaws formed in the head of the shank and secured with a pin or pivot on which they move in one direction; by this means, when in use, one arm is brought quite down upon the shank (as in fig. 2), lessening considerably the strain or leverage on the shank, and removing a great source of danger to shipping. A further advantage presents itself in the improved construction which the patent anchor admits of. The arms and shank of a common anchor being made in separate pieces, and then welded at the crown, the risk, in the hour of peril, of failure from an unsound weld, is great. But, in the patent anchor, the shank and arms being made apart, the latter can be laid up with bars extending from pea to pea, thereby securing the full strength of the metal. It is said to cant and bite quickly in the most stubborn ground. The advantages in stowing, from the arms taking apart from the shank, are strikingly evident. Numerous trials made by an experienced marine surveyor, Capt. Denham, R.N., fully bear out all that we have stated in regard to the advantages of this anchor over that in common use; with this addition, that the same effect is produced at one-twentieth less weight. The small projection on each arm is necessary to bring the fluke, as shown in fig. 1, into a position for entering. From a personal inspection of this anchor, and a perusal of certificates of its efficiency, from officers of the highest rank in H. M. navy—in which its general adoption is confidently expected, we have no hesitation in recommending it to the profession. For steam-vessels it appears to be peculiarly fitted, as also for floating light-houses, break-waters, and piers. Brown, Lennox and Co., of Billiter Square, are agents for the sale of this patent anchor; and they will give every information to inquiring parties relative thereto.

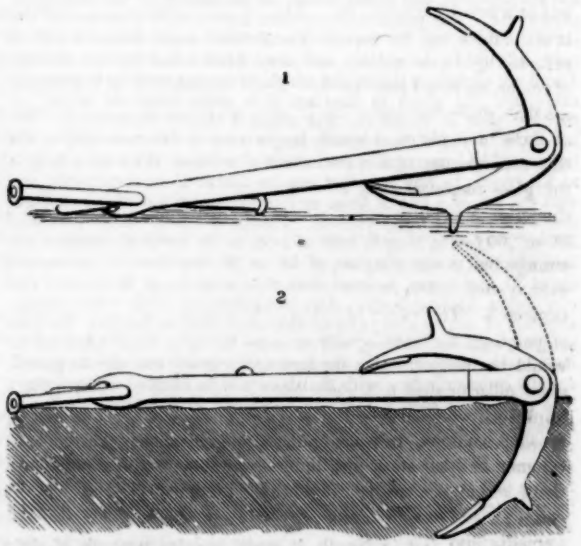


Fig. 1.—Position of the Anchor when canted. Fig. 2.—View of the Anchor in the ground, with the upper pea on the shank, in which position it remains. The dotted line shows the position in which the upper arm of a common anchor would be if placed by its side.

ON SHOP DECORATIONS, AND THE APPLICATION OF GLASS TO ARCHITECTURAL DETAILS.

TO THE EDITOR OF THE SURVEYOR, ENGINEER, AND ARCHITECT.

Sir,—The exterior decoration of shop fronts has recently occupied much of the attention of architects; and the growing taste of the public for architectural embellishment—as evinced in those recent but almost abortive attempts at effect in Regent-street, Piccadilly, and in the Strand—is calculated to render much service to the profession if rightly administered to. It cannot be doubted that sound architectural decoration, applied to shop fronts, from being constantly before the eye of the public, is better calculated to implant a love for the art, and consequently raise the art itself, than any other mode that can be adopted; and I think that *artists* of the first rank will gather laurels, and render the profession and the public at large a great service, by coming forward and showing what can be done in the way of shop decoration, or forcing

those who now *do* the architecture of shop fronts to produce something more worthy of the present age. What I have principally to complain of in the way of exterior shop decorations is the incongruous absurdity and expensiveness of many of the attempts at architectural effect, and the total want of *feeling* in carrying out the design. How frequently we witness a gilded, bedizened basement, decked out in showy finery, and all above plain stucco or dirty brick. Not that I should expect to see the expensive character adopted on the ground or shop floor pursued throughout the elevation—far from it—it would be a ruinous waste; but I should wish to see the *spirit* of the design carried out, and not let it appear, to the most superficial observer, that the architect had exhausted himself on the basement. But, to the object I had in view in penning this letter. I have been much surprised at the rich appearance of a silversmith's shop window in King William-street in the city, which at first I was at a loss to account for. The effect is produced by a polished brass plate fixed obliquely in the reveals of the shop window, the reflected light from which produces an extraordinary mellow richness of colour, such as I have never before witnessed. Now it appears to me that, if silvered amber-colour plate glass was fixed in the position of these brass plates, it would produce a very superior effect. And this reminds me of a question I was about to ask—How is it that the glass manufacturing art—now arrived at such perfection that draperies and other such-like fabrics are wove of it—has not been in any way applied in decoration, except for looking glasses? It is strange that a material, imperishable, yet capable of producing the most splendid effect in architectural embellishment, has been entirely neglected. The effect of gilding, how much soever burnished,—of painting, the most gaudy,—of polished stones, the most rare,—would be insignificant compared with glass. The appearance of a glass pillar or shaft to a table lamp is exceedingly effective, and I think such would also be the case if similarly employed as standards for shop windows, in place of mahogany or metal. The capitals of columns and pilasters, mouldings, and other architectural decorations, might, I conceive, be cheaply produced in glass; and I am certain would exceed in appearance the most sanguine expectation formed of it. The shafts of columns and pilasters might also be easily masked with a covering of ground or coloured glass. Hoping that you will find room for these remarks, I beg to subscribe myself,

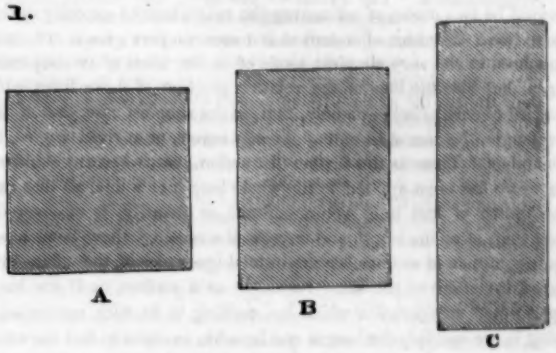
March 14, 1840. AN OBSERVER.

PROPORTIONS OF BEAUTY IN SIMPLE FIGURES.

(CONTINUED FROM PAGE 31.)

IT will be borne in mind that we stated the approximate proportion of the length and breadth of the rectangle of beauty to be as 10 to 7. These do not express the proportion exactly; for 10 is the diagonal of a square, and 7 is the side of the same; and the diagonal and side of a square are incommensurables, and cannot be exactly expressed by any numbers whatsoever. It is to be understood that the 10 and 7 may express any measures whatsoever, or any fractional parts of named measures; and that, whatever the unit, or standard of measure, in these two numbers may be, it must be the same in both, and its meaning must be the length of some line, which line may however, as we have said, be of any length. If we multiply 7 and 10 together, 70, their product, will express seventy squares, having all the sides equal to the measuring unit. Farther, every rectangle, whatever may be its proportions, in which the product of the length and breadth amounts to 70, must have the same area or superficial content as the rectangle of beauty, of which 10 and 7 are the length and the breadth. In illustration of this, we introduce the following simple diagram:

1.



In this example, A is a square, B the rectangle of beauty, and C another rectangle, of which the length is 14 and the breadth 5. These three figures contain very nearly equal areas, and those of B and C are exactly equal. That of the square, A, differs a little, though but a very little, from the other two; because the side of the square is not commensurable with either the length or the breadth of the rectangle of beauty; and thus, if we had taken an exact square for the figure A, the other figures would have been incommensurable with it. Therefore, the approximate proportions of the rectangle of beauty were assumed; and the square root of 70, their product, which is 8·37+, taken as the side of the square. The dimensions of the rectangle C were taken at random; and the assumed area, 70, divided by the assumed length, 14, gave 5 as the breadth. This third rectangle is made up of four rectangles of beauty, having their length 5, and their breadth 3½; and four such rectangles would also of course be obtained by bisecting the rectangle B by parallels in the direction of its length and of its breadth. Simple inspection of the figures will show that there is the greatest apparent stability, but at the same time an expression of heaviness, in the square, A; and that there is an instability in C as compared with the others; and it is obvious that this air of instability would become greater and greater as the figure were lengthened and narrowed, until its breadth and area vanished into an interminable straight line.

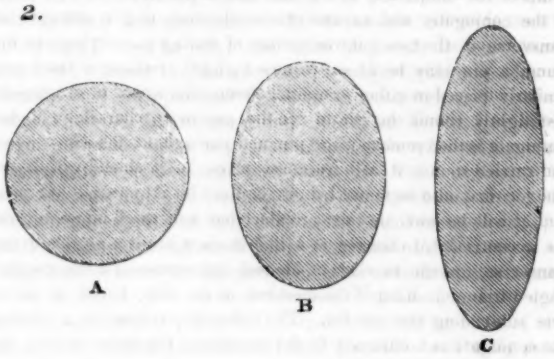
The fact of a rectangle vanishing into an *interminable* straight line is a property worth bearing in mind; and it applies to every figure of which the shape is altered by increasing one dimension, and diminishing the cross or conjugate one, preserving the same area, until the cross dimension vanishes, and that area becomes 0.

The general deduction from this, which though tacitly admitted is not always understood, is that no length of line can be equal to any area however small; for two squares, one with the millionth part of an inch for its side, and another with a million of miles for the same, would both ultimately vanish into interminable straight lines, and therefore be equal to each other in the instant of vanishing. In like manner it might be shown that two cubes, or two solids of any kind, how different soever they might be in their contents, would both vanish into interminable surfaces, and thus be equal to each other in the instant of vanishing. This, however, is foreign to our present purpose, although it may not be wholly useless to those who have not studied the subject,—inasmuch as the general principle which it shows is that a surface cannot be made up of lines, unless they are interminable ones, which it is of course impossible to obtain,

and that a solid cannot be made up of surfaces, unless they are interminable and impossible. The idea of a line is a comparatively simple one—the distance between one point and another, and there cannot be two modes of estimating the magnitude or quantity of the same line. The idea of a surface is more complex; for it not only involves, in the very simplest mode of it, the ideas of two separate lines, but also the idea of the relative position of those lines with regard to each other,—namely, that, in the simplest case, that of the rectangle, the one shall extend directly across, or at right angles, to the other. There is this further distinction, that, when any standard measure has been applied to the whole length of a line, all that can be known of that line, as a magnitude or quantity, is discovered; but that, after the length and breadth of a rectangle have been accurately measured as lines, we are in total ignorance of the value—the area or content of the same rectangle as a surface, until we have performed an operation which has nothing to do with measuring; that is, we multiply the length and breadth, in order to find the area. This is an arithmetical operation, in the mode of its performance; but the result of it is quite different from any arithmetical result, inasmuch as the product is a quantity totally different from both of the factors whose multiplication furnishes that product. In the case of a solid, even of the most simple solid—a cube or rectangular prism, there are three measurements necessary, namely, those of the length, the breadth, and the thickness; and the lines representing these must have one definite relation, that is, each of them must be at right angles to the other two. When they are accurately measured by the same standard, and all three are multiplied together, which requires two operations in multiplying, the product of the three gives the content of the solid in cubes, the edge of which is equal to the unit of the lineal measure in which the three dimensions were taken.

But although areas are found by multiplying length and breadth, and solidities by multiplying length, breadth, and thickness, yet there is something more in these operations than there is in multiplication arithmetically considered. The product of a common multiplication is of the same kind with one of the factors, and expresses as many times that factor as the number 1 is contained in the other factor; but when length and breadth are multiplied, the product is neither so many times the length nor so many times the breadth, but a quantity in its nature totally different from both; and its species depends, not upon the values of the length and breadth as factors, but upon the fact of their standing in a particular relation to each other—that is, being at right angles. So also, in the case of the value of a solid, expressed by the multiplication of the length and breadth, and then by the multiplication of their product by the thickness, it is not the mere fact of those factors being lines of certain definite lengths which makes the product of the three represent the content of a solid, it is the fact of their being so related to each other that every one of them is at right angles to both of the other two. When these principles present themselves singly, they are easily understood, but they are complicated cases in which they are mixed up with other elements; and, when such cases occur, there is always danger of being misled, and that on account of the very simplicity of the principles themselves. Indeed there is no subject to which less attention is paid than the analysis of those relations, distinct altogether from the mere consideration of quantity, which form the essence and geometry; and for the want of due knowledge of which most of the geometrical errors of surveyors, engineers, and architects, are committed. This is our plea of justification for what to some may seem an interpolation; and as such subjects introduced under their own specific names would not be read, we may, as occasion offers, introduce slight notices of them.

2.



In these three diagrams, we have endeavoured to give the same specimens of a curvilineal figure as we previously did of a straight-lined one; and, as we did in the case of these, we have here given the same length and breadth as in the rectangles, and the same area or surface in each of the figures. A is a circle, which, if applied to the square in the former diagram, would touch the middle of each of the four sides; and B and C are ellipses, which, if applied to the corresponding rectangles in the former diagrams, would touch them in the middle of the length of each side, and the middle of the breadth of each end. The circle and ellipse are not commensurable with the square and the rectangle in their surfaces, or in their bounding lines; for a curve and a straight line are not quantities of the same kind, and neither of them can be exactly expressed in terms of the other; but approximations sufficiently near for all practical purposes may be obtained. Thus, for instance, if each side of a square is counted 1, and the perimeter consequently 4, the circumference of the circle inscribed in that square and touching each of its four sides in the middle will be 3·14159. The area of the square in this case will be 1; and if we divide the circumference of the circle by 4, the approximate area of that figure will be ·7854 very nearly, that is, a little more than three-fourths of the area of the square. The same proportion also holds between the area and surface of every ellipse, and those of the rectangle which that ellipse touches in the middle of both its sides and both its ends. Therefore, the three figures in the second diagram which have their diameters equal to the sides of the square and the rectangles in the first diagram, have all equal areas, and their bounding lines increase in quantity with the increase of the length and diminution of the breadth, in exactly the same ratio as the rectangles. The circle which answers to the square has but one centre, and all its diameters are equal to each other, and also to the side of the square which it touches internally in four points. The ellipses, on the other hand, have two centres; and the property of the ellipse is such that the sum of the distances of every point in the circumference from the two centres is always the same, and equal to the transverse or longest diameter. Hence, independently of other considerations, those who are not furnished with a trammel or other instrument for describing ellipses have a very easy way of drawing these figures of any form and dimensions that may be necessary. All that is required for this purpose is, to draw a straight line of the required length of the transverse or longest diameter, and cross it in the middle by another straight line at right angles, equal to the conjugate or shortest

diameter, and having exactly its half on each side of the transverse. This being done, half the transverse is to be taken between the points of the compasses, and if one foot is placed on the extremity of the conjugate, and an arc of a circle described, it will cut the transverse in the two centres or foci of the ellipse. These being found, a pin may be placed firmly in each of them, a third pin similarly placed in either extremity of the conjugate, and a thread tied tightly round the three. If the pin in the extremity of the conjugate is then removed, and a pencil put in the loop of the thread and carried round, it will trace the ellipse with perfect accuracy. The foci may also be found by calculation; for, from what has been said, it will be obvious to the reader that half the conjugate, and the eccentricity or distance of either focus from the centre of the transverse, are the two sides including the right angle, in a right-angled triangle, and that the semi-transverse is the hypothenuse, or side subtending the right angle. Therefore, if the square of half the conjugate is subtracted from the square of half the transverse, the square root of the remainder will give the eccentricity; and this, set off both ways from the middle of the transverse, will give the two foci, from which the ellipse may be described as before stated.

So much for the mode of describing the ellipse; and, from what has been said, it will be seen that an ellipse is nothing but a circle presented obliquely to the view, and having its transverse diameter longer in proportion to its conjugate in proportion as it is more oblique. If the area is the same, as we have represented it in the above figures, there is a countless number of ellipses between the circle and the straight line into which they ultimately vanish when the conjugate diameter becomes 0, and the transverse interminable. The circle, or primary figure, is, like the square among rectangles, expressive of strength, but not of beauty; and the interminable straight line into which the ellipses finally vanish is expressive of perfect instability, in which there can be no beauty, any more than in that which represents mere strength. We have to seek the ellipse of beauty somewhere between those limits; and the eye itself, upon seeing them when described, will instantly fix upon that which is marked B in the diagram, and which answers to the rectangle of beauty in the diagram first given.

A circle or an ellipse, or some arc either of the one or of the other, is the figure usually adopted in the construction of arches, whether for ornament or for use, or in that perfection of the constructive art, in which utility is rendered beautiful, and beauty useful; and, if such an arch is perfect of its kind, the semicircle or the semi-ellipse is the most perfect, inasmuch as no other portion of either curve will pass into the straight lines of the abutments or piers without an angular transfer from the curve to the straight line, which is in all cases a deformity. The semicircle is the strongest arch which can be formed of any of those curves; but it is far from being the most beautiful, for the sight of it is as offensive to one's higher feelings as that of a round bullet head upon a human being, which completely spoils the dignity of the figure, how perfectly symmetrical soever it may be in all its other parts. For this reason, no engineer or architect of good taste will ever introduce a semi-circular arch into any structure having the slightest pretensions to elegance. The perfect contrast to the circle is the straight lintel, such as was used by the ancients, who were acquainted with scarcely any principle of stability excepth the strength and mass of the material which they employed; and this, notwithstanding the huge blocks of stone which they made use of, confined them within narrow limits in the height of their buildings, unless the apertures of those buildings were disproportionately small. The beautiful arch must be sought for between the semicircle and the straight lintel; and it must be lower than the first, and higher than the second. A semi-ellipse, standing in its conjugate diameter, makes a most unsightly arch; for the whole opening which it tops always looks as if the sides of it were squeezed together by some unnatural pressure. A semi-ellipse, standing on its transverse diameter, is therefore the proper curve in which to seek for the arch of beauty; and, upon comparing a number together, it will be found that the proportions of the ellipse marked B furnish a more graceful curve than any others. When this is made use of, the proportions are, 10 for the span of the arch, and 3½ for the height of the crown above the line drawn from the springing at the one side to that on the other. If this arch is used for a purpose in which the ornamental predominates, as for a gateway, a door, or a window, then the most harmonious application of abutments to it is obtained by applying to it the rectangle of beauty standing on its shorter side, in the case of a window or door of a house; and on its longer side, in the case of a carriage gate. Thus, for instance, if the straight sides of an arched door or window are made ten feet high, and seven feet apart, and an elliptic arch of two and a half feet rise is turned over them, the outline of the aperture will be more elegant than if it had any other proportions. So, also, if the piers of a gate are seven feet high, ten feet apart, and have a semi-ellipse of three and a half feet rise turned over them, the appearance of the opening will also be perfect in its way, and though not so elegant as the former, it will have a greater expression of stability taken as a whole. There are many other applications of the relation of 1 to the square root of ½, which will occur to any one who has studied forms sufficiently for giving elegance to any structure he may be required to erect; but what we have stated must suffice in the meantime, although we may be permitted to add, that this first and simplest element of beauty is too generally neglected.

PARISH SURVEYS:

THEIR WRETCHED EXECUTION, AND THE NECESSITY AND MODE OF THEIR IMPROVEMENT.

In another part of the present number there will be found a letter on the manner in which Parish Surveys have been executed, with some pretty sharp strictures on the "penny wise and pound foolish" conduct of the authorities to whom the execution of this important work has been delegated. "Parish business" has long been proverbial for the bungling manner, to say no worse, in which it has been performed; and in this matter they have been more than usually astute. In very many instances, low price has been the sole object with these sapient men of office, and upon this principle contracts have been entered into per score of parishes, or per whole union, with parties so ignorant of surveying that they could not read the brass marks on a Gunter's chain, or even tell the difference between that and a chain cable. These parties have taken the contracts low, let them out to whoever would execute them lower, still without the slightest inquiry as to their qualifications, and the consequence has been that the style of execution has been lower still; so low, indeed, that many of the surveys are worse than useless; and they must either lead to perpetual misunderstanding and squabbling, or be done over again, at a double expense.

Now, why should these things be? Why should this, which is really a national work of importance, be allowed to get into the hands of crafty jobbers and wretched bunglers? And wherefore is it, that while every man employed by Government, even in the humblest department, must undergo an examination before he is appointed.

This matter originated with Government, and the fact of such being the case involves an obligation upon the Government to see

that it is well done. This is the more necessary, inasmuch as the real science and art of surveying lags sadly behind in this country; and thus damages, and greatly increases, the expense of many a public work of first-rate cost and importance. Here was an opportunity of giving good practice to young surveyors, and by this means laying the foundation of a school of surveying. If the parties actually employed had been examind by a board or other assemblage of competent parties, such parties could have given supplemental instruction, where it was found to be necessary. This has not been done, and the consequence is, that with some exceptions no doubt, the parish surveys of England are a shame to the authorities, and a nuisance to the country.

THE ROYAL EXCHANGE QUESTION.

It is curious that what we in our last number recommended in joke some one else should, at the very same time, have proposed in earnest, namely, that the former Royal Exchange should be adhered to as the model for the new structure. Such is the purport of a letter published in the last number of the Probe, and signed, "An Old Architect."

"It appears to me," says the writer, "that the occasional restoration of buildings to their original forms, after such an accident as has occurred lately, is good taste, where their merit has been recognised." True, where an edifice is of such universally recognised merit and beauty, that its destruction is a positive loss to art, the restoration or revival of it becomes not only a laudable, but almost an imperative course. Had it been Henry VII.'s, or King's College Chapel, at Cambridge, which had been destroyed, we should have said replace it by a perfect fac-simile of the original; but, as regards the late Exchange, we are of opinion that, as a piece of architecture, it is not at all to be regretted. There was much in it that was positively bad and ugly, even with reference to its particular style, and we therefore hold all that the "Old Architect" says by way of excuse for the "unclassical" practice of turning arches upon columns, not only to be irrelevant, but to lead quite astray from what ought to be the real question. Every one is aware that it is contrary to the system of Grecian architecture. What then? If that system is altogether repudiated, and another established, different both in its principles and its character, yet admitting other though dissimilar beauties, we may very well be allowed to dismiss arguments that serve only to perplex, and are not only idle, but absolutely nonsennsical.

For our own part, we protest against that micrologic pedantry which refers every thing to one conventional standard. We admire Grecian architecture for what it is; and we sincerely wish that those who profess to follow it would give us more of its real spirit and genius than they at present do. Yet, are we therefore to admire nothing but Grecian architecture? which we will say—*sotto voce*, is after all exceedingly limited and monotonous, for, if we except minor discrepancies of detail, nearly all Grecian temples present the same general outline and plan, namely, a parellelogram of solid walls, surrounded by columns, and having a pediment at each end. Thank heaven! our taste is not quite so tethered, but that we can extend our admiration to many other styles of the art, which possess qualities and beauties that will in vain be sought for in the most exquisite remains of Athenian or Hellenic architecture. With a great deal to condemn, there is also very much to admire in Italian architecture, which is so comprehensive a term that it embraces modes widely distinguished from each other, in point of taste. Indeed, in the best, the good is rarely unmixed with alloy; and it is therefore for the architect to discriminate between the two, to adopt the one and avoid the other. In some Italian examples, combinations of arches and columns produce a singularly picturesque and happy effect; several instances of the kind occur in the courts of the Genoese palaces, and a superlatively fine one is furnished by that of the Palazzo Piccolomini, at Sienna, the work of Francesco di Giorgio, an architect whose name is less familiar to English ears than that of Palladio, but who is worth a hundred of the latter.*

There certainly is nothing contrary either to reason or principle, in supporting arches upon columns, because construction both warrants it, and allows it to be done without any of those shifts and artifices frequently resorted to, in order to produce forms that do not naturally result from the nature of the building, or its mode of execution. On the contrary, there is even a reasonableness and propriety in rejecting a horizontal entablature, and employing arches springing from columns instead of it, where very wide intercolumns are required, because, in such cases, horizontal architraves offend the eye by an appearance of weakness, and the whole columniation becomes straggling and poor, whereas such defect is immediately got rid of by carrying the arches over the inter-columns, whereby, besides obtaining an expression of strength instead of that of weakness, the spaces become better proportioned, being increased in height, by the semi-diameter of the arch. This mode also allows, without impropriety, of the columns being placed in pairs, the reason for doing so being sufficiently obvious. In our opinion, therefore, it is a mere futile objection to say that such practice is entirely at variance with all precedents of Grecian, or even of Roman architecture, at its best periods: most undoubted it is; and, where Grecian architecture is professedly imitated, it would be preposterous and absurd; and, we may also remark, *par parenthese*, that it is, though not an uncommon, an offensive solecism, to introduce even arched windows in buildings otherwise affecting to be strictly Grecian in style, and where intercolumns much wider than such apertures are covered horizontally by architraves. It would, indeed, be manifestly in bad taste to employ any example of the Grecian Doric, or other Grecian order, for such purpose, because it would too forcibly remind us of the style that is in all other respects abandoned. Arches on Pæstan columns would make but a barbarous composition, although nich columns are seemingly very well adapted for the purpose on account of their massiveness, but then the severity of style they display, and their decided expression, render them unfit for any purpose except their original one; yet columns nearly as massive in their proportions, but altogether different in character, might be so employed, as is the fact the case in some of the Lombardic buildings of Italy, where short columns approaching in the decoration of their capitals to those of the Corinthian order, or style, are to be met with. If it be said that the use of arches upon columns arose from the barbarism and ignorance which prevailed during the decline of the art in the later periods of the Roman empire, we may be allowed to reply, the origin of the practice is of no importance, except historically, the main question being, whether that mode is capable of being refined, and moulded into beauty, which we certainly think it is. In such matters, all theory and *a priori* argument ought to go for very little; for, according to them, many buildings ought to be very beautiful which are nevertheless the reverse. Much more than is generally suspected depends upon the actual treatment of the style adopted; accordingly as a spirit and gusto are infused into it, or the contrary; hence, what in the hands of one man becomes either insipidity or

* Nevertheless, Quatremere de Quinay makes no mention whatever of Francesco, in his lives of celebrated architects.

ugliness, may by another be endued with grace, and rendered most captivating—at least to the unprejudiced,—to those who are not obstinately bent upon admiring or censuring precisely according to precedent, or to their own pre-conceived notions.

So much for the heresy of columns upon arches. Instead of objecting to that mode upon principle, we are persuaded that it admits of very great beauty and gracefulness, to say nothing of picturesque character, if treated with ability and taste. There are some, indeed, who affect to hold taste very cheap, as if it were in the power of any one to command it—if he pleased; which, it seems, every one does not care to do. Yet, of all the dangerous and detestable heresies in art, we hold the depreciation of *æsthetic* quality or taste to be the worst. In fact, those who either do or profess to entertain it plainly contradict themselves, because that doctrine absolutely nullifies all the rules and precedents for which they are such great sticklers; since what else do such rules aim at except the securing good taste, as far as it can be done by adhering to them?—which, to say truth, it seldom can be, unless there be also an informing taste that pervades the whole design. Our objections to the old Royal Exchange, and more particularly to that very part of it which the Letter we have taken as our text recommends should be built anew, supposing "no design decidedly better shall be produced," are that, taken altogether, it was most uncouth and barbarous; fantastic in its architecture, yet without a spark of fancy, most intolerably licentious, but also most intolerably dull; intended, it may be presumed, to be rich and grand, yet only a huddled-up, patched-up, assemblage of the meanest frippery. "The architecture of the interior, or quadrangle," says the Editor of the "Illustrations of the Public Buildings of London, 1838," "was not at all in better taste than the exterior, rather still less so; poor and straggling below, confused and whimsical above; encumbered with coarse and trivial ornaments, that produced littleness instead of grandeur, perplexity instead of richness." Among other intolerable caprices of design it presented, the architrave of the upper order—it amounts to irony to term it so—was cut through by oval windows, as may be seen in the annexed perspective view. Though not the most fastidious of critics, Ponz, who notices some of the public buildings of London, in his 'Viage fuera de Espana,' censures the architecture of the Royal Exchange, saying, "*toda la decoracion carece de elegancia.*" And yet, notwithstanding its utter want of elegance, we now find a professional man urging that the quadrangle, at least, of the old building should be taken as the model for a new one.

In our opinion it will be a most decided slur—a flagrant stigma upon the profession and the architectural talent of this country, if no design "decidedly better" can be procured. At this distance of time, and after the cursory inspection we were compelled to take of such a number of drawings, we cannot pretend to say to which of those that were exhibited we should, upon leisurely examination, be disposed to give the preference, but we remember one with a spacious circular cortile, surrounded by an arcaded ambulatory, above which was Ionic order in half or three-quarter columns, with pedimented windows between. We understood it to be by Mr. J. Davies, the architect of the elegant new synagogue near Crosby Place, and certainly thought it possessed much merit, as well as incontestable beauty of plan. In some of the designs, we thought that the Exchange part or court of the building appeared too narrow in proportion to the height, and consequently confined; in fact, more like a mere avenue than an area suitable for the intended purpose. Either a perfect square, or a circle, would, we conceive, be not only the most agreeable, but most commodious form for such an area.* Perhaps a combination of the two would be better still; that is, a circular or cylindrical area inscribed within a square, which, if we mistake not, is the plan of the Dublin Exchange, where there is a peristyle of twelve columns supporting a dome that covers the central space. We may further remark that the exterior also of that building is exceedingly good, and possesses much character; nor would it be amiss if it were looked, for the purpose of seeing whether any idea could be taken from it. At all events, we would strongly urge upon those who have the management of the building, the propriety and prudence of now employing the utmost caution and deliberation, because, while more or less delay is now matter of comparatively little importance, it is of very great importance that the design ultimately fixed upon should be not only "decidedly better" than that of the former structure, but most decidedly better than any of the rejected ones also; in short, a decidedly superior one,—such as will be an honour to the metropolis, a credit to British architecture and British art.

DEMISE OF SIR JEFFRY WYATVILLE, R.A., F.R.S., F.S.A.

THIS eminent architect, who, in the restoration of Windsor Castle during the reign and under the patronage of George IV., erected for himself so splendid a monument, died at Windsor, on the 18th of February, in his 74th year, he having been born on the 3rd of August, 1766.

An entire month has elapsed since the death of this very eminent man; and it says not much for the spirit of the public press, that the only tributes which have been paid to him have been a few bare newspaper notices, and brief summaries in one or two of the periodicals. Now, if Sir Jeffry had merely "fretted his hour upon the stage" of amusement or frivolity, and especially if his reputation had been a little tainted by his enactments there, we should ere now have had the proverbial number of a cat's lives of him vamped up, and set forth, by that section of authors and publishers who live from day to day by snatching at the "jetsum and flotsum" of the stream of time. But as, like other great men, his name will stand monumental for ages in his works, he does not need such perishable fame as parties like these can bestow. Yet it is passing strange that the British public should be thus tempted to waste their time and their money upon the chaff of society, to the neglect of the wheat,—that they should be bidden to worship the dust that is blown about by every wind and disregard the rock, which remains steadfast in its sublimity for a hundred generations. Such, however, is the fact, in so far as Britain is concerned. "They manage matters differently in France." Of Nimmo, whose knowledge of the philosophy of Engineering, as applied to nature on the grand scale' was unrivalled, we have never met with any account, save a meagre statement in an obscure Glasgow paper; nor has one of the countless hints, invaluable to the profession, which must have been contained in his papers, been given to the public. Even of Telford, the grand theatre of whose labours was Britain, and whose plans and papers were preserved, the memoir is by no means a readable book,—although there were traits in the character of that man, both personal

* The dimensions of the old quadrangle were 144 feet by 117, owing to which, it could be called neither a square nor a decided parallelogram but looked as if intended to be the former, but accidently made otherwise.

The Exchange at New Orleans, which was destroyed by fire last February, was a rotunda, covered, we believe, by a dome, and so far a much better model for the purpose than our own late Royal Exchange.

and professional, which, independently altogether of his plans and works, would have formed the substance of a delightful volume. We looked for something of the kind from the author of the Pleasures of Hope; and we have wondered, and continue to wonder, why his pen could be dry, or his lyre, once so wildly sweet, could be dumb when he lost Thomas Telford. We believe it is a maxim with the Parsees, never to worship the setting sun; but we are quite sure that Campbell has not the slightest leaning to that faith. Of Rennie we have no memoir at all, although his, too, was a life of incident as well as of eminence; but Rennie has sons worthy of him; and his memory may be heritage to them too sacred for being given to the public, considering the general scope of very modern biography. Indeed, the only work which is a readable memoir of British engineering is the reports of Smeaton; and these contain nothing personal, except in so far as the spirit of the man is rendered in the book, while substantially it treats of other matters.

But to return to Wyatville:—He was born at Burton-upon-Trent, and received his scholastic education there. Upon leaving school he was anxious to go to sea, but his friends having prevented that, he came to London, and served his apprenticeship to an uncle who had visited Italy, and was practising as an architect in London, where he built the Pantheon in Oxford-street, and several other structures. When thirty-three years old, Sir Jeffry went into partnership with a builder who executed large contracts for Government; and in this occupation, which he followed for five-and-twenty years, he not only amassed a considerable fortune, but gradually gained no small degree of knowledge and taste as an architect. It appears to have been those qualities which induced George IV., himself a man of great architectural taste, to select Mr. Wyat as his own architect, for executing the splendid renovation which he purposed to make on the magnificent castle of Windsor; and, in order to be convinced how judicious the monarch was in his choice, and how magnificently the architect discharged his duty, one has only to go to Windsor, and see, and admire, and be overpowered by the grandeur of that most magnificent of palaces. It must not be understood, however, that, though Mr. Wyat was selected by the King, he tamely obeyed every royal suggestion in the progress of the work. He was no doubt grateful for the appointment, and loyal to George as the British sovereign; but he did not look upon his majesty as king of architecture, and, therefore, disobedience to the royal will, in that, he held to be no treason; and, were it not that they were communicated to us in confidence, we could mention a good many instances in which the architect stood sturdily up for the grandeur and congruity of the building; and resisted, nay, positively refused and countermanded, certain prettyisms which his majesty had wished to introduce. Such resistances were almost unavoidable; for, though George IV. was a man of taste, his taste was mixed, so that he could not so clearly perceive the line of distinction between bijouterie and building as the architect, whose very soul was in the former, but who gave himself comparatively little trouble about the latter. One case, however, we may mention, inasmuch as the account of it was not given to us in confidence as were the others. When the king's private apartments were to be constructed, his majesty objected to the dimensions proposed by Sir Jeffry, as being too large, which would render the rooms cold and uncomfortable. Sir Jeffry objected to this reduction of the scale; but the King expressed a positive determination to have his own private abode agreeable to his personal wishes. Sir Jeffry said no more, but went on to complete the apartments of the size which he himself, and not according to the royal order. When they were finished and furnished, and his majesty went to view them, he was quite in raptures, and asked Sir Jeffry whether he did not admire the taste of the royal order. "Yes," said Sir Jeffry, "but I have taken the liberty of doubling all the dimensions proposed by your majesty."

The first stone was laid on the King's birthday, August 12th, 1824, the king himself presiding at the ceremony. At the same time, wishing to distinguish his own architect from Mr. James Wyat, who had been architect at Windsor during great part of the reign of George III., and also from the rest of the Wyat family, he granted his royal permission to change the name to Wyatville; and at the same time knighted the architect.

Besides Windsor, Sir Jeffry was employed in many parts of the country, chiefly in erecting, enlarging, or improving the mansions of the nobility. It is said that there are works designed by this architect in five-eighths of the English counties, and one-third of the Welsh, amounting in all to more than a hundred structures and parts of structures. Nor were his labours abated till near the day of his death; for he designed lodges for the duke of Devonshire's park at Chatsworth only three months before his death; and the style of those lodges show that there was no abatement of that boldness and vigour which pervaded all that he planned. He also erected several works on the continent for the relations of the Queen Dowager, and at her suggestion. When all these works are considered, we may say with truth, that he stands in need of no other memorial than what he himself has made.

His remains were deposited at the back of the altar in St. George's Chapel, Windsor Castle, in a vault which he had prepared some time ago for those of his youngest and favourite daughter. His funeral was attended by real mourners only, chiefly men like himself, eminent in the arts; and her majesty the Queen was pleased to show her regard for his memory, by ordering his bust to be placed in the long gallery of Windsor Castle.

OBSERVATIONS ON THE DIURNAL VARIATION OF THE MAGNETIC NEEDLE AT FALMOUTH.

By T. B. Jordan.

[REPORT OF THE ROYAL CORNWALL POLYTECHNIC SOCIETY.]

These observations were made at the request of Captain James Ross, R.N., on the 22nd of March, 1838, that being the day chosen for similar observations in London, and at various stations on the continent. The instrument used had a needle twenty inches long, suspended by a few fibres of unspun silk: the poles were finished with double graduated arcs (on Mr. Fox's plan), the relative distances of which, from the points of the needle, were so adjusted that a difference of position amounting to 15″ could readily be discovered. The instrument was fixed on a stone base, and the zero of its scale adjusted to the mean position of the needle: every precaution was taken to remove local attraction.

Falmouth meantime.		Variation from O.			Falmouth meantime.		Variation from O.		
H.	M.				H.	M.			
6	30 A. M.	2′	0″	East.	1	45 P. M.	4′	30″	West.
6	45	9	0		2	0	3	0	
7	0	10	0		3	15	2	50	
8	0	14	0		4	0	3	30	East.
9	0	9	0		6	0	6	30	
10	0	1	0		6	30	10	0	
10	45	2	30	West.	7	0	12	15	
11	0	3	30		8	0	10	0	
Noon.		9	0		9	0	10	0	
0	30 P. M.	9	30		10	0	10	0	
1	0	10	15						

ADAMS'S VERTEBRATED RAILWAY CARRIAGE, WITH BOWSPRING BEARERS, AND TRACTORS.

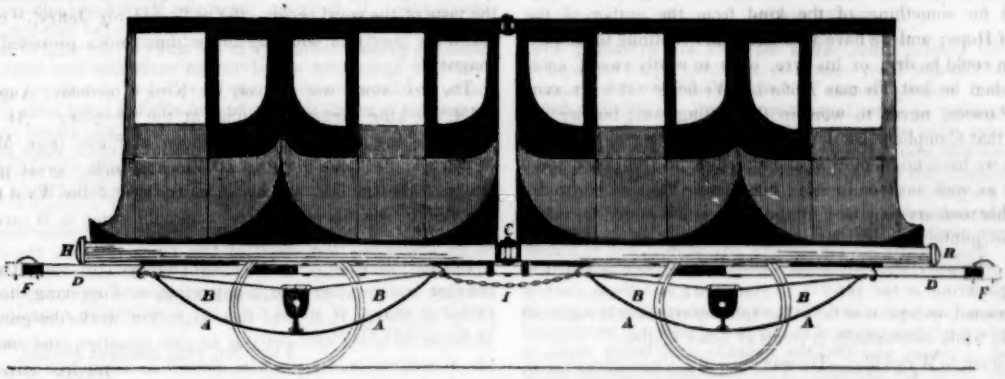


FIG. 1.—*A* The bearing bowsprings supporting. *B* The cords or lever links which would sustain the weight if the springs were removed. *C* Vertical joints permitting the carriage to bend laterally when passing round curves or irregularities of the rails. *D* The central rod for traction and propulsion.

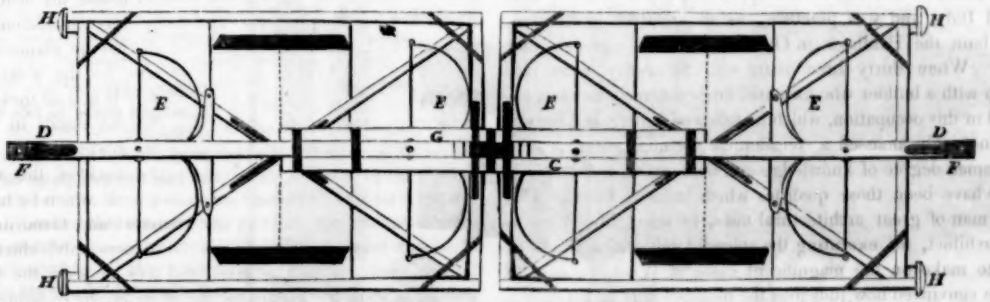


FIG. 2.—*E* Horizontal bowsprings to which the central traction and propulsion rod is attached. *F* Coupling links to connect the carriages together. *G* Slide arrangement permitting the central traction rod to shorten in case of longitudinal concussion while the train is propelled thus allowing the bufferends, *H*, to abut against the adjoining carriages when the horizontal bowsprings are overpowered. In traction, the rods are connected by a chain, *I*, which serves to bind the extending power. It will be perceived that, in traction, the aggregated horizontal bowsprings have more pliability than when the carriage is propelled. In traction, also, the engine draws a train of rods to which the carriages are attached, each by its separate springs, and thus each carriage in succession is put in motion with less stress on the engine than when the whole train is moved at once.

THE advantages of the improved method of suspension and construction adopted by Mr. Adams, in so far as relates to railway interests, we look upon as deserving the most serious attention. The maintenance of way is one of the very heaviest items of railway expenditure; and when it is considered that these defects are substantially caused by the concussion of engines and carriages on the rails—causing also their own rapid destruction—we think any scheme that promised to remedy or alleviate those vital defects should meet with the most careful and prompt attention. The principle on which Mr. Adams has proceeded is good, and we are much surprised that the method has not long before been adopted. The bowspring suspension—with great ease of vertical motion, admits, also, of a considerable lateral action of the body of the carriage, but without causing any danger. The bowsprings are equally applicable, the inventor asserts, to locomotive engines as to common carriages; and he informs us that he has recently forwarded a set of the springs to Sir James Anderson, for his common-road locomotive. Certainly, if any thing could cause common-road steam locomotion to look up, it would be this invention.

The more permanent benefits arising from this form of carriage are, that it will pass round curves of very small radius with loose wheels without risk, and with perfect surety of keeping on the rails, thereby greatly increasing the durability of the carriages, which, as at present constructed, are destroyed by their rigidity. The carriages may also be so constructed as altogether to dispense with turn-tables, and will also permit the cones of the wheels to be much diminished, so as to approach more nearly to true cylinders.

First-class carriages made on this construction are reduced in weight about one half, sixteen persons and a guard being carried in each with as easy a motion as that of a private chariot.

The traction springs of the carriages are so arranged that the springs of each carriage sustain no more weight of draught than the single carriage to which they are attached; and each carriage is started in succession by the engine, which is an essential in luggage trains, and desirable in all.

The centre of gravity may be lowered nearly one half,—compared with the first-class carriages on the London and Birmingham, the floor of the carriages being brought within fifteen inches of the rails. The usual noise and jarring are so much diminished, that the motion, on passing over an iron rail laid on a stone block, is nearly as steady as when the rail is laid on longitudinal wood sleepers, which must greatly increase the durability of carriages and roadway. The above form of carriage is that adopted by the Birmingham and Gloucester Railway Company, the action of one of which was described in our first number. But the form can be varied, with little additional weight, so as to obtain four bodies on the same carriage.

PATENT MALLEABLE IRON CHAIR.

TO THE EDITOR.

Sir,—At the present time, when railroads are extending over every part of this and other countries, any thing which can tend to give additional security to this mode of travelling must be considered as a matter of some importance. I am, therefore, induced to bring under your notice a patent, which I took out some time back, for malleable iron chairs or pedestals, for railways, as a substitute for cast-iron. Of the advantage of wrought-iron over cast-iron for such a purpose, there can be little doubt; but hitherto the invention has not received that degree of attention which every new discovery merits, where additional security to life is the consideration. These chairs can be rolled of any weight, and of almost any shape, and can be cut with the circular saw as fast as they are rolled.

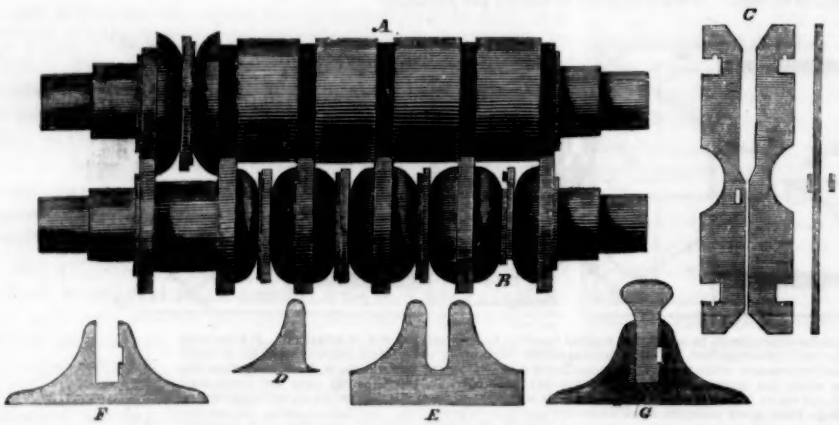
An objection has been raised that, as no two engineers agree as to which is the best description of rail, a pair of rolls will be required for every set of chairs, and that the quantity used being small, it would barely cover the expense. This objection is correct as to the difference of opinion, each engineer having his own form of rail, but on any of the principal lines of road taking the chairs, even at a fifth of the weight of the rails, the quantity would be very considerable. If, however, the chairs were found, on trial, to be, as they no doubt would, infinitely superior to the cast-iron, it might occasion a greater uniformity in the make of the rail, so as to adapt it to that figure best suited to the malleable iron chair. These chairs, as I have observed, may be rolled of almost any shape, and the manner in which this can be best effected is by rolling them out of slabs, with ears, suited to the chair required, placed on the slab forming, in a great measure, the appearance of the chair itself.

The accompanying drawing will show the rolls, the mode of piling the iron, the mandril, and also a chair lately rolled for a nobleman in the north of England.

Where security is gained, some additional expense ought not to be an objection; but, even in this point of view, the extra cost would be but trifling, as the weight of the chair would be less in the first instance, and the heavy expense of replacing the broken cast-iron chairs, of which there are considerable quantities, would be altogether saved.

I am, Sir, your obedient servant,
HARRY SCRIVENER.

Ruabon, Denbighshire, Feb. 26.



A—Chair rolls.
B—Mandril groove, to form the keyhole.
C—Mandril.
D—Ear.
E—Pile, with ears placed on the slab.

		Inches.
F—Finished chair;	width	9
	heighth	8
	depth of groove ..	2¼
G—Chair and rail;	weight of rail, 55 lbs.	

From the Mining Journal.

BALLYSIMON STONE.

TO THE EDITOR OF THE SURVEYOR, ENGINEER, AND ARCHITECT.

Sir,—The correspondence of Messrs. Barry and Smith respecting the merits of the Ballysimon marble, condemning it as a material unfit for architectural purposes, either as regards appearance or durability, having already appeared in the "Surveyor, Engineer, and Architect," I feel sure that I need only appeal to your justice to induce you to insert the following remarks in the next number of that magazine.

A petition inquiring why the Bolsover stone was to be used in the construction of the intended New Houses of Parliament, in preference to the Limerick marble, which I had offered (gratis) to the Government, having been presented to the House of Lords, it was referred to the Parliamentary Commissioners appointed to report on stone; viz., to Messrs. Barry, De la Beche, C. H. Smith, and W. Smith; and thus the correspondence in question was elicited. In the following examination, I will place the objections to the stone, and my answers to them, in succession, that the reader may compare them at a glance.

Mr. Barry states that he considers the Ballysimon marble as ineligible for the New Houses of Parliament, on account of its colour, and the cost of the labour of working it, which would render its adoption more expensive than that of several other stones of this country, of equal durability and more favourable colour.

Answer.—We request those who wish to have a correct idea of its colour to visit the obelisk in the Westminster Gardens, to contrast its colour with that of the stone in the adjacent buildings, and to remember that it is the property of the marble to become bleached by exposure even to the smoky atmosphere of London. As the marble is harder than other stones, it will cost more to work, but this expense is compensated by its greater durability and original smaller cost. I am not aware of any stone in England of equal durability, which could be procured for the purpose.

Mr. W. Smith states that he never saw this kind of stone used in any building of the least architectural pretensions; but in one front of Trinity College, Dublin, where, from the *pyrites* which the stone contains, the walls are in a bad "*mouldering* state." The comparative degree of dampness instantly appears on holding together squared specimens of the Limerick and Bolsover stones (both being rubbed specimens), and breathing strongly on them while in contact.

Answer.—At Limerick may be seen, not only ancient, but modern buildings of this kind of stone, which would do honour even to London. Mr. Smith, it appears, has not seen the Wellesley Bridge, at Limerick, the Thomond Bridge, Lord Mounteagle's column, the Jail, the Asylum, the elegant Savings' Bank (now being erected by Mr. Owen, the architect and civil engineer under the Shannon Commission), &c. &c.

Sir Christopher Wren was aware of the durability of this "kind of stone," and of its power to resist the attrition of human footsteps. He made use of it for the steps of the great western portico of St. Paul's, where its durability may be compared with that of Portland stone. The stone of the Trinity College, Dublin, which is in a bad mouldering

state, from pyrites which it contains, may be a stone perhaps similar in some respects to the Ballysimon, but it is dissimilar in one important particular; it is found *to decay*, whereas the Ballysimon marble is known to be imperishable. The structure of the latter is uniform, consisting of equal compact crystals of carbonate of lime, and it does not contain *decomposing pyrites*.

I confess that I do not exactly understand Mr. Smith's breathing experiment; but, if he mean that by breathing on pieces of the Limerick and Bolsover stone, when placed in juxta position, wet will be found on the Limerick and none on the Bolsover, I grant it; and what is the cause? The Bolsover has imbibed the moisture, and it has condensed on the Limerick, therefore Mr. Smith would see the moisture of his own breath on the Limerick stone, as he would by breathing on a piece of glass.

The Ballysimon marble, from its uniform density, is not liable to imbibe water, or add to its special water of crystallization, and hence it is not affected by wet and dry, or by frost. So far from absorbing water, water cannot be forced into it, at a pressure of 17·620 lb. to the inch, applied by Perkins's machine. Its specific gravity is two and seven-tenths, and a two inch cube of it cannot be crushed by a pressure of twenty-eight tons, applied by a Bramah's press.

Mr. Smith states that, used in a building, it will grey a little in dry weather, and blacken in wet, or with fog, or the least moistness.

Answer.— The Bolsover stone readily imbibes, without pressure, three per cent. of water, and of course readily gives it out again.

All stones are darkened by the wet, but all stones will not become immediately dry when the wet ceases, as the Ballysimon does. It is, we know, supposed that the Bolsover dolomite will become harder and less porous by exposure to the air; but, should such be the case, it will have previously imbibed so copiously the unctuous black matter of the sooty rain of London that there will be just cause to lament over the loss of the beautiful bloom which this Bolsover dolomite had in its youth, and to weep over its dirty black in age.

Mr. W. Smith, speaking of the Ballysimon marble, says, "giving this black limestone the specious name of marble, because it admits of a polish, is a sad misguiding perversion of terms."

Answer.—We refer Mr. W. Smith to the opinion of Mr. C. H. Smith, who states, "*I consider it to be a material precisely similar to Kilkenny marble.*"

I believe such a material has been called marble since the time of the Romans; or what is or was the Lucullite of the ancients?

It is well known that there are modern buildings in London which are already falling into decay, from the perishable nature of the stone of which they are built. Now, I have specimens of the Limerick stone taken from ruins of great age, and the tooling is as perfect as on the day it was worked; it is also a known fact that the stone of the break-water of the old Thomond Bridge, at Limerick, was perfect after the waters of the Shannon had spent their force on it for 1200 years; their only effect having been that of partially polishing the surface.

As these, Mr. Editor, are facts, and not mere assertions, or speculative opinions, would it not be just, both to me and the public, that this Ballysimon marble or stone, good or bad, should have a trial, for it now stands condemned by the opinions of three individuals, Mr. Barry, Mr. C. H. Smith, and Mr. W. Smith; for Mr. Delebeche, the only scientific geologist in this commission, does not join in the correspondence. I am ready to furnish any architect or engineer, who is willing to test it by use, with blocks (which I will supply gratis), and to furnish anybody and everybody with specimens; all I ask is a fair trial, and let the material stand or fall by its own merit. I can assure you that it is with great reluctance that I have entered into this contest respecting the comparative merits of the Bolsover and Ballysimon stones; but I felt that the knowledge of the fact that Government had consented to pay 3*s.* 6*d.* per foot cube for the Bolsover dolomite, when I had offered the use of the Ballysimon quarries (free gratis for nothing, as we say in Ireland), must tend to depreciate the latter in public estimation; and, as a company is now formed for the purpose of working them, I feel it my duty to reply to the principal observations contained in the letters you published.

I have the honour to be, Sir, your very humble and obedient servant,

M. J. Staunton.

March 23, 1840.

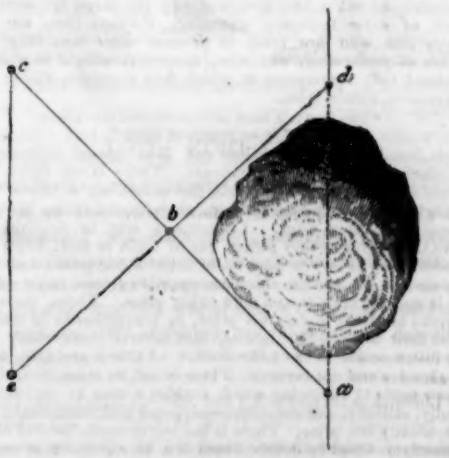
Office of the Limerick Marble and Stone Company,
9, Charing Cross.

DETERMINING INACCESSIBLE DISTANCES.

Sir,—In page 42 of the "Surveyor, Engineer, and Architect's Journal," is given a method by A. D. C., "for ascertaining the diagonal distance through a building."

I have been in the habit of practising the method pointed out by a *Surveyor* for many years past. I beg, however, to observe that his last remark is superfluous, as $f\,b$ is $= e\,g$, and $f\,i = e\,k$, consequently the lines $i\,k$ and $b\,g$ are identical, and $b\,g$ is equal to $f\,e$, whether the building be out of *square* or not, the sides b and d being parallel to each other. The line $k\,i$ would only be required in the case of a projection at the end of the building passing beyond the line $b\,g$, in which case it would be requisite to extend the line $b\,g$ to $i\,k$, in order to avoid any abutment, or lean-to, that may be attached to the end of the building, and narrower than the building itself. But distances across pits or ponds of water are more frequently required than through a building, but for which purpose the above method is not applicable. Buildings may generally be seen at a distance, and consequently are easily avoided in laying out lines, but in the case of pits, they are frequently not seen until you approach nearly up to them, and then become serious obstacles to the surveyor's progress.

The following is the method I adopt in such cases, and which I have practised for nearly 30 years:—Suppose I want to ascertain the distance $a\,d$ across the intervening pit or pond, measure a straight line from a to c, and also from d to e, making $b\,c = a\,b$, and $b\,e = b\,d$, then, by similar triangles, $e\,c$ is equal to $a\,d$, whence, by measuring $c\,e$, we get the distance $a\,d$ as was required.



I am, Sir, yours respectfully,

J. Utting,
Civil Engineer and Surveyor.

Lynn Regis, March 2*d*, 1840.

(Phil. Mag. Vol. 66, P. 272; 1825.)

Note by Surveyor.—The concluding passage in our remarks on the article on measuring a diagonal distance through a building, which was given in the last number, and referred to by Mr. Utting, is certainly superfluous as it at present stands, but a lean-to or small projection at the end of the building was *supposed* by us, although certainly not expressed.

K

PARISH SURVEYS.

(FROM THE WEST BRITON.)

SIR,—It is pretty generally known that the majority of first class maps sent to the tithe office have failed under the examination to which they have been submitted;—the difficulties of constructing a map with the required accuracy, in counties so hilly, thickly wooded, and enclosed, as Devon and Cornwall, are being assigned as a sufficient reason for the inaccuracy. The fact stated, that the greater number of maps sent from these counties (and very probably from others) have been returned as inaccurate, is undoubtedly correct, but it appears to me that the reason alleged for this failure is not the true one.

The counties of Devon and Cornwall certainly present obstructions to a surveyor's progress, in a measure peculiar to themselves; but, by skill and care, these difficulties may be overcome, and maps constructed which shall bear such tests and examinations (rigid as they are) which are applied at the Tithe Commutation Office. This *has been* done in Cornwall, and I have not heard of any failure where the landowners have given a price which would command that professional skill and talent which are certainly necessary to the accurate construction of a first class plan of a parish. But in those numerous instances in which the landowners have incurred the disappointment and delay attending the refusal of a map sent to the proper office for the purpose of being tested, the persons employed have been chosen, not on account of their competence for the work they undertake, but solely on account of the lowness of their offers, and the shortness of the time in which they engage to complete it. It is a very easy matter to undertake and to promise, and landowners would have acted more prudently, if, in the first instance, they had (what experience has now taught) considered the probability or possibility of the *performance* of those extravagant promises which are never wanting where a piece of work is open to public competition. I would not undertake to prove that the dearness of a thing is a correct measure of its excellence, but this I believe is a general rule with those who study true economy (and I do not see why this rule should not obtain in respect to parish surveys), *that eventually it is always the cheapest plan to give a fair market price for any purchaseable commodity.* There are many in all walks who have had painful experience of this truth, but, I should think, none more so than those who have in their niggardliness caught at an offer for the survey of their lands at a price, perhaps, one-half a fair remunerating one; and, having advanced money to enable the surveyor to proceed, have found, after a tedious and expensive delay, that the money they have too incautiously advanced has been uselessly (*to them*) transferred to the pockets of some imposing pretender. Perhaps there are too many in every line who are ready to promise more than they have any intention of performing, and who, moreover, will, if they can, obtain beforehand that recompense to which their promises, rather than their performances, entitle them.

> "The first is a trick not uncommon nor scarce,
> But the last is an impudent thing."

Second-class surveys *may cause* and *have* caused ultimate distrust, dissatisfaction, and renewed expense. There is no check upon the accuracy of a plan of this kind but the *conscience* of the surveyor,—a very slight one, it may be presumed, when he undertakes his work at an unconscionably low price. Landowners may be deceived and may deceive themselves as they please, but, if truth be told, there never *was* and never *can* be a *fair* plan made but at a *fair* price; and the reason is plain—that the charge which custom allows respectable surveyors to make is nothing more than a bare living price. Those, therefore, who undertake to survey *under* this price, in proportion to its lowness must neglect their work. The fact is, that several plans which have been made instrumental to the commutation of tithes *are little better than mere sketches and eye surveys.* There is not, as some foolishly suppose, any new mode of surveying which enables a man to perform his work carefully, skilfully, and conscientiously, and still remunerate himself, at an apparently low price. There is but *one* accurate method of surveying (differently modified by different men it is true), and *that* requires professional education, skill, and experience, and, above all, a reasonable allowance of time, to practise successfully.

It is strange that a measure of such immense and permanent importance as the commutation of tithes, which, if now carelessly or ignorantly performed, will entail perpetually on land an unjust and unequal assessment, should ever have been committed to hands whose sole recommendation was the cheapness with which their services might be procured; but the folly of this mode of proceeding having been abundantly and painfully made manifest in so many instances (which must be generally known), it is useless to dwell on it further.

I beg to repeat, that it is not owing to the difficulties, numerous as they are, which this county presents, that accurate plans have not been furnished, but entirely to the unskilfulness of the hands employed, the lowness of the price, and, especially, the shortness of the time afforded; that plans which will bear any test may be and have been constructed; and that there are persons in every way qualified to construct them, but who have been hitherto shut out from competing for the undertakings in question, by those who have been dishonest enough to promise what they know they cannot perform, and by those who have been foolish enough to put their trust in such faithless and extravagant promises.

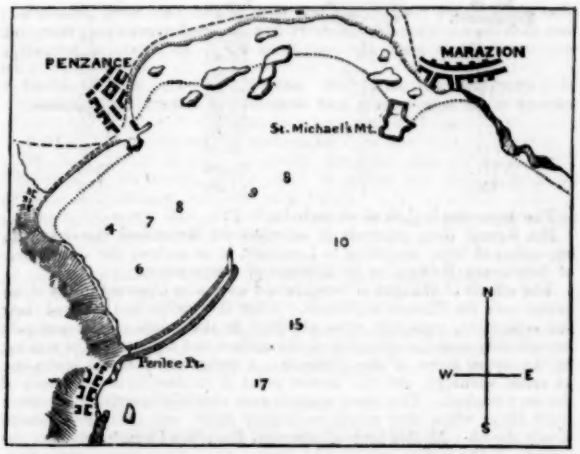
I am, Sir, very respectfully,

Your obedient servant, B. J.

NOTE BY A SURVEYOR.—The strictures contained in the above letter are well merited, and the facts perfectly correct. We can state, from our own knowledge, that in very many instances *lawyers* have actually undertaken parish surveys; and it is well known that some of the London map-makers have embarked largely in what they please to term the *speculation*. Architects, auctioneers, house agents, and men of similar pursuits, have also eagerly embraced the *chance* of making money out of parish surveys. Need we scarce remark that such men, even if competent to judge of the accuracy of a parish survey (the surveying of it themselves is out of the question), have no interest in it beyond making as much money as possible. A competent surveyor has his whole character at stake, and moreover takes a pride in producing an accurate map.

MOUNT'S BAY BREAKWATER.

THE position of Mount's Bay, which is the most westerly inbend of the channel coast of England, renders it peculiarly eligible as a haven of safety for vessels both outward and inward bound. As a commercial harbour, it could never be of much importance, as Penzance, the town which is situated upon it, never can have much trade, and the country to which that town is the port is very narrow. Not only this, but the chief commercial product of the adjoining, namely, that of the mines, is carried in the opposite direction, at least, in so far as copper is concerned. Still, however, without any reference to a commercial port, this bay is most advantageously situated as a haven of safety, as may be seen by any one who glances at the form of the coast, from Landsend to the Lizard. Upon doing this, it will be seen that this bay opens to the south-west, the point whence the channel wind generally blows; and it often happens that a ship inward bound, which makes a landfall near the Scilly islands, cannot weather the Lizard without great danger of running ashore, or great loss of time. In certain states of the wind, too, it is exceedingly difficult for any vessel to leave Falmouth, or any port above the Lizard, although, in the same states of the wind, Mount's Bay could be departed from with the greatest ease, inasmuch as there is plenty of sea room for beating, either to work round Landsend, or round the Lizard. In consequence of this, the Guiavos lake, or north-west position of the bay, immediately south of Penzance, would form a most convenient anchorage; but, as a heavy swell rolls into the bay, vessels would ride hard, and probably port their anchors and drift ashore, if they had not the benefit of a breakwater. This breakwater, the gentlemen of the locality estimate at about a quarter of a million; and they wish for the aid of government to enable them to carry it into execution. This wish is a reasonable one, inasmuch as the work is more of a national than of a local character; and if there be any one subject which more than another requires the assistance of a judicious and liberal government, it is that of affording the means of accommodation to the people generally. In this respect, attention to maritime affairs is more obligatory upon the British government than that of affairs of any other kind; for though the wealth and strength of British land are by no means to be despised or neglected, the real power and greatness of the country are connected with the sea. We understand that the patriotic Cornubions, whose object it is to promote this work, though repeatedly denied, have a fresh memorial before the authorities; and we hope that the said authorities will accede to its just and necessary prayer.



The accompanying cut represents the line of coast and the position of the breakwater, and from these it will be seen that still water may be obtained behind the breakwater, in almost every state of the wind. The tide in Mount's Bay, whether its wave sets eastward with flood, or westward with ebb in the main channel, is a wave tide; and by the time it reaches the position of the breakwater it is much exhausted, and would produce very little agitation. The geographical position, too, renders a harbour here very advantageous for ships from the French coast of the channel, from the shores of the Bay of Biscay, and from all places where the channel forms part of the navigation. As a port of safety, either for single vessels or for the largest fleets, there is no situation in the channel at all comparable with it; for it is the only one which can be made or departed from in safety, let the wind blow from what point it may. It is for this reason that the supineness of Government, in affording the very moderate assistance which the promoters of this national work would require, is so much to be regretted. Railway communication with the proposed breakwater, in continuation of the line now forming to Exeter, is not only pronounced practicable, but exceedingly easy of execution.

REVIEWS.

THE PRINCIPLES AND PRACTICE OF LEVELLING; BY EDWARD JONES, ARCHITECT AND CIVIL ENGINEER. SECOND EDITION.

Our chief inducement for mentioning this work is its smallness and simplicity, which render it a good first book for beginners in that branch of the Surveying and Engineering arts of which it treats.

The common instruments, and methods of using them, are plainly described, and also the leading errors to which those instruments are liable. There are, however, some theoretical passages in Mr. Jones' work, or in the authorities which he quotes, which might as well have been left; but, as they relate to the nature of light, a subject with which practical men have not much to do, they are at all events harmless; and, notwithstanding them, we must again repeat that the book is an exceedingly useful one for beginners.

SUPPLEMENT TO EUCLID; BY W. D. COOLEY, A.B. 1840.

This little volume consists of 120 propositions in plane Geometry, with their demonstrations; and, with few exceptions, they are the same as those which form the appendix to Mr. Cooley's edition of the Elements. As geometrical exercises they are ingenious; but as none of them are what may be called leading propositions, that is, propositions upon which any important practical rules may be founded, we think that, at least in so far as students of geometry are concerned, they are much more valuable without the demonstrations. One and all, they are corollaries, some more obviously, some less obviously, deducible from the principles laid down in the Elements; and thus the enunciations of them are good exercises to those who are studying Euclid; but, with the demonstrations, they increase the field of geometrical labour, or rather of the labour of merely conning over, without any corresponding addition of real knowledge. From the general scope of them, it is easy to perceive that Mr. Cooley is an expert geometer, but he must pardon us for thinking that talents like his might have been employed to a more obviously useful purpose. When we say this, however, we are far from denying the merit of his work, for that, in its way, is unquestionable. We wish, however, that he had dared at once to cut the Gordian knot of plane geometry, instead of rendering it a little more tangled. The want, in Euclid, and it is followed by all geometers, is the rejection of motion as an element; although the science cannot be applied to any useful purpose, nor can a diagram be made, or a line drawn, without motion of some kind or other. In the postulate granting that any circle may be described about any centre, and in that granting that a straight line may be produced to any length in the same, the idea of motion is involved, though not avowed; and the want of this avowal is the cause of much trouble afterwards.

THE YEAR-BOOK OF FACTS IN SCIENCE AND ART, FOR 1840; TILT, FLEET STREET.

As this little work is a professed compilation, giving in general the authorities from which the different articles are taken, and containing little or no original matter, it calls for no critical examination of the contents, either as to their subjects or as to the way in which those subjects are treated. It is, however, very neatly got up, and contains a great deal of valuable matter in small compass: that matter is skilfully selected, and, where abridgment has been required, that has been judiciously performed; the arrangement is also good, consisting of the several heads of mechanics, natural philosophy, electricity, chemistry, natural history, geology, astronomy and meteorology, and geography, with an obituary of men eminent in science. It is furnished with a copious index alphabetically arranged, and, altogether, it is an excellent little volume, and one which can be consulted with great ease and readiness. For these reasons, it deserves a due share of public encouragement.

INSTITUTION OF CIVIL ENGINEERS.

Jan. 14.—Joshua Field, V.P., in the chair.—The following communications were read:—

1. "Observations on the efficiency or gross power of steam exerted on the piston in relation to the reported duty of steam engines in Cornwall at different periods," by J. S. Enys.—The advantages which may result from the union of scientific and practical knowledge in the application of steam power, particularly with reference to the limits of gross power, are great, as likely to check the extravagant notions entertained by some with respect to the further increase of duty, and to remove the disbelief of others with respect to the amount of duty actually performed. The limit of duty for atmospheric steam may be readily arrived at, as was done by Mr. Davies Gilbert, in 1827, by estimating the weight of water which would rise 34 feet into a vacuum formed by the condensation of steam of atmospheric strength; whence it appears that a higher duty

than 30 millions cannot be obtained by atmospheric steam, 14 cubic feet of water being evaporated by a bushel of coal. Tredgold, in the first edition of his Treatise on the Steam Engine, published in 1827, adopted the simpler method of multiplying the volume of steam of atmospheric strength by the pressure, for the measure of the efficiency: this principle may be extended to measure the efficiency of steam at higher pressures. The author then proceeds to show, that the Cornish engines are worked under conditions such that a large proportion of the expansive action of the steam is available on the piston, and calls attention to two necessary corrections,—1st, for the deficiency of water in high steam cut off at 1-5th of the stroke; and, 2nd, for the increase of temperature of the steam during expansion in the cylinder, as derived from the steam jacket. The experiments of Mr. Wicksteed, confirmatory as they are of the very extended experiments made by Woolf at Wheal Alford, show the importance of this latter correction. Some error has also arisen from the use of the boiler pressure. The exact determination of the pressure in the cylander is difficult, and the only recorded experiments are those by Mr. Henwood, with the common indicator, and published in the second volume of the Transactions of the Institution. The quantity of water evaporated was very perfectly recorded; it was stated by Watt, as from 8 to 12 cubic feet per bushel, and at present may be stated at about 14 cubic feet, but is sometimes, with good coal and careful stoking, much higher. The author briefly alludes to the progress of improvement in Cornwall; the introduction by Woolf of high steam; the substitution of the plunger pole for the bucket pump, and the application, so recently made by Mr. James Sims, to stamping or crank engines of the arrangements which had been a long time so advantageously used in pumping engines.

2. "Analysis of a piece of iron converted, by the action of sea water, into a substance resembling plumbago," by D. Mushet.—In this communication Mr. Mushet gives the result of his analysis of a piece of the iron heel-post of a vessel, called the *John Bull*, which, by the effect of salt water, was converted into a substance resembling plumbago. This substance was of a dark brown colour, and easily cut by a knife; on being exposed to a red heat, in a crucible, it lost about 20 per cent. in weight, and on being exposed to a white heat for four hours, it lost about 60 per cent., and came out a light mass of very brilliant carburet. This shining carburet was then used as a carbonaceous substance for the reduction of an oxide of iron, but was less efficacious than the same quantity of the charcoal of wood. From these and other experiments, Mr. Mushet considers 100 parts to be composed as follows:—

Carbonic Acid and Moisture	20
Protoxyde of Iron	35·7
Silt, or earthy matter	7·2
Carbon	41·1

3. "On the expansion of Arches," by G. Rennie, Esq.—The expansion of solids, which has excited the attention of mathematicians since the investigations of La Hire, in 1688, on a rod of iron, is of particular importance in the construction of bridges, the security of which may be affected by the dilatation and contraction consequent on changes of temperature. Periodical motions, referable only to changes of temperature, were observed by Vicat, in a stone bridge built over the Dordogne, at Souillac, and have frequently been noticed in structures of all kinds. The different expansibilities of stone and iron have been considered an objection to the use of cast iron pillars in connection with stone, to support the fronts of buildings; but the experiments of Mr. Adie, of Edinburgh, led him to the conclusion that no danger is to be apprehended from a change of temperature affecting cast iron and sandstone in any great degree, as their expansion, so far as regards buildings, may be considered the same. Arguments from this source were employed against the arches of Southwark Bridge, and the experiments set forth in this communication were undertaken with a view of ascertaining the effect of temperature on these arches. Three sets of experiments were made: the first, in January, 1818, when the main ribs and diagonal braces rested on their centres, and before any of the spandrels and road plates had been put upon them; the second, in August and September of the same year.

The rise was measured by the insertion of small wedges to about $\frac{1}{10}$th of an inch. The third set of experiments was made on the eastern arch. Three thermometers were employed—one hanging in the open air, another having the bulb immersed 1½ inch in the iron, and the third hanging amongst the ribs; these were observed at different hours of the day, and the results recorded. The rise of the arch was observed by a fine piece of feathered edged brass, nicely fixed to the rib, which by the rise and fall of the arch traversed upon a scale graduated to $\frac{1}{10}$th of an inch. The tables contain experiments on nine days, with the temperatures and rise at every hour of the day. The results, that is, the maximum temperatures and rise, and rise for 1° F. are exhibited in the following table.

No. of Experiment.	Variation in Temperature.	Rise in Arch.	Rise for 1° F.
I.	15°	25-80	1-48
II.	10°	16-80	1-50
III.	7·5	13-80	1-47
IV.	11°	22-80	1-40
V.	6°	13-80	1-87
VI.	4·5	10-80	1-36
VII.	3°	9-80	1-26
VIII.	8°	14-80	1-45
IX.	7·5	21-80	1-28

The mean rise is $\frac{1}{10}$th of an inch for 1° F.

Mr. Rennie then proceeds to calculate the theoretical rise from the expansion of iron, according to Lavoisier, in an arch of the dimensions of Southwark Bridge, for 50° increase of temperature.

The effects of changes of temperature were also observed in the stone bridge over the Thames at Staines. After the arches had attained their full settlement, openings were observed in the joints of the parapets immediately over the springing of the arches, and a distortion or sinking of the upper curve of the parapets. A wedge was inserted into some of these openings, and the lowest point of its descent in the month of January marked. The same wedges were carefully inserted every week until May, when they would no longer enter, and the joints became firmly closed. At this period, however, the joints immediately over the crowns of the arches, which had during the winter been quite close, were now open. From these facts it followed, as a necessary consequence, that, in winter, the arch contracting descended, and the spandrel joints opened, and, in summer, the arch expanding rose and closed these joints, and opened those at the crowns. Thus the joints of the parapets, which were made of single slabs of granite for the whole height, became good indicators of the changes of temperature. It had also been observed, in the Waterloo and other bridges, that joints made good in the winter with Roman cement were found crushed in summer.

With the view of obtaining some data for calculation, Mr. Rennie procured samples of granite, sandstone, and slate, and placing them in a properly constructed oven, ascertained the rates of their expansion, which are given in the paper.

A series of experiments was made, at the request of the late Mr. Rennie, by Mr. S. Walker, of Rotherham, on the variations in the length of 231½ feet of the frieze, bolted together, and laid on a firm platform. The temperature of the atmosphere, and of the plates, and the length, were noted at five o'clock in the morning, and at three o'clock in the afternoon; and, in some of the experiments, at seven o'clock in the evening. The details of these experiments are given in the paper.

The paper is accompanied by calculations for the rise of an arch, and the opening at the spandrels for an increased temperature, and also by tables of the expansibility of different kinds of stones and irons given by Distigny.

4. "Specification and working drawings of the Middlesborough-on-Tees Gas Works," by P. Henderson.—In this communication, the author details the several works, erections, and fittings of the Gas Works at Middlesborough-on-Tees, and the mode in which they are to be executed and completed.

5. "On a mode of dowelling timber, or of combining it and other materials for general purposes," by M. J. Brunel.—The author proposes to unite timber by means of iron dowels and asphalte. Mastic had been used in the tunnel works for the purpose of fitting small plates of cast iron to the poling boards. These, though constantly immersed in water and mud, and subject to severe hammering, had stood perfectly well. Asphalte is now used in preference to mastic, as it sets immediately. The author conceives that stone may be united by a similar kind of dowelling; and that wood may be interposed between stone and iron, so as to be used to advantage with the stone blocks, for the chairs of railways. Also, that this method may be used with great advantage in ship-building, in mast-making, and wherever any species of dowelling is required.

EMBANKMENT OF THE RIVER THAMES.

On the 28th ultimo, Mr. Hoard (the Chairman of the Navigation Committee) brought up the Report recommending a petition to be presented to the House of Commons on the subject of embanking the river Thames.

The line of embankment is proposed to extend from London-bridge to Vauxhall-bridge. The Commissioners of Woods and Forests agree with the committee in the proposed line, and the petition to the House of Commons was for leave to bring in a bill to carry that great object into effect. Upon the part of the government Mr. Walker had drawn a plan, and upon the part of the city Mr. Leach had drawn another, and both had conferred and produced a joint plan, which would be calculated immensely to improve the metropolis.

Mr. Lott moved an addition to the petition, that it would be desirable to convert such embankments as were suggested, when practicable, into public walks, conducive to the health and recreation of the inhabitants of the metropolis.

Sir M. Wood opposed the addition. He stated that the project of embanking the Thames according to the plan agreed upon by Mr. Walker and Mr. Leach would prove to be a source of considerable profit to the city of London, instead of being, as some imagined, an expense.

Mr. R. L. Jones strongly advocated the noble plan of improvement suggested in the report, which could be carried into effect without increasing the pecuniary liabilities of the city.

The petition was then adopted, and ordered to be presented to the House of Commons that evening.

LONDON AND BLACKWALL RAILWAY.

PROPOSED METHOD OF WORKING THE LINE.

Engineers' Report.—Gentlemen,—In compliance with your instructions, we have the honour to lay before you a detailed statement as to the present position of the works upon the several parts of the Blackwall Railway.

We had hoped that the railway would have been opened to the Minories next month. But from the present advanced state of the works on the whole line, the opening from the Minories to Blackwall will not be postponed for any considerable period.

The whole of the unfinished portions of the viaduct have recently been put into the hands of the contractors, who are now proceeding with energy upon them, and they involve nothing that is calculated to retard their completion beyond the end of April.

The ballasting of the road is in a state of great forwardness, and in a month from this time will be nearly completed. The engine-house in the Minories is nearly erected, and Messrs. Maudslay, Sons, and Field, have commenced fixing the machinery there.

The engine-houses at Blackwall are in rapid progress, and in about a month from the present time will be ready for the reception of the machinery, which is all prepared and in part delivered.

In consequence of inquiries which from time to time are made, we feel that some explanation is desirable respecting the mode to be adopted in working the Railway, and we therefore trust that a few observations to render this clear will not be out of place on the present occasion.

It is, we presume, generally known that you intend to establish several intermediate stations between London and Blackwall, although by the direct course of the Railway the distance is little more than three miles and a half. This accommodation could not be afforded on so short a line if worked by locomotive engines, without either doing away with the velocity usually attained on railways, or by having recourse to more lines of rails, which would of necessity involve an increase of locomotive power, and add largely both to the permanent and current expenditure. By means however of stationary engines, the desirable object of working intermediate stations for the convenience of passengers is easily secured.

The plan adopted to accomplish this is as follows:—assuming that between London and Blackwall there are three stations, A, B, C, respectively, then the trains starting from London and drawn by the Blackwall engines would consist of at least four carriages. The carriages might be more numerous for every station, but, for the sake of perspicuity in the explanation, we will assume for each one carriage only.

The foremost carriage will be that destined to go all the way to Blackwall; the second, that to the station C; the third, that to the station B; and the fourth, that to the station A. In the transit to Blackwall, station A is first reached; but, previous to arriving at it, the last or fourth carriage is detached from the train, and is stopped opposite that station, whilst the rest of the train is still progressing.

The third carriage is detached and stopped in like manner at station B, and so on till the carriage for Blackwall has arrived at its ultimate destination. The engines then cease working, and the rope which has been drawn from London, and is to be the means of reconveying the carriages back, is in a state of rest. While remaining so, the carriages at their respective stations are loaded and attached for their return, so that in due time when the rope is set in motion by the London engines, all the carriages are started simultaneously. The carriage which was last in the train towards Blackwall thus becomes the first, and is attached to the rope a mile or two nearer London than the most remote carriage, and as they are all attached to the same rope they obviously travel at the same speed, though at such a distance apart. It then follows that the carriage from station A arrives first in London, and occupies the furthest portion of the depot. Then follows the carriage from station B, and so on until the last carriage from Blackwall has arrived, when the engines again cease working, the carriages being thus left in their proper relative positions for their next transit towards Blackwall.

To these arrangements the utmost effect will be given by the adoption of the Electric Telegraph of Professor Wheatstone and Mr. Cooke, similar to that which has been for a considerable period in successful action on the Great Western Railway.

We have the honour to be, Gentlemen, your most obedient servants,

GEORGE STEPHENSON,
GEORGE P. BIDDER.

Great George-street, 26th Feb. 1840.

RECORD OF PUBLIC WORKS.

GREAT WESTERN RAILWAY.—The stability of the permanent way has been severely tried during the last autumn; and it is very satisfactory to find, that during this period, the cost of maintenance has been very moderate, being, on the average of the last half year, only 5*l.* 18*s.* per mile per week. At this cost the road has been kept generally in very excellent order: and except at two points, where large springs of water have lately, for the first time, suddenly appeared, for which proper drainage had not been prepared, no difficulty has been experienced.—*Extract from Mr. Brunel's Report.*

SOUTH-WESTERN RAILWAY.—This railway, in common with all others of recent construction, has suffered much by the action of the weather upon its newly formed works. To such an extent has this been the case that it has only been by the exercise of unremitting vigilance, that the line has been kept open, and free from those disastrous accidents which, without great care, would inevitably have occurred. It affords the directors much gratification in being able to inform the proprietors that, although to maintain the road in a state of safety during the passing winter has been a matter of considerable difficulty and great expense, more so than can be expected at any future time, seeing that the works will, before another winter, have attained a much greater degree of solidity; still there has been no instance of personal accident to any passenger; thus proving that, under careful management, railroads furnish the most safe as well as the cheapest and most expeditious mode of conveyance. The expense, however, has been considerable. To maintain the road between London and Basingstoke, and to restore it from the effects of slips and unusual subsidence to a proper state will, in the opinion of the engineer, occasion an extraordinary expenditure beyond the sum which may be fairly charged to "maintenance of way" of nearly 50,000*l.*—*Extract from Directors' Report.*

LONDON AND BRIGHTON RAILWAY.—The Brighton and Shoreham Rail-way will be opened to the public on Easter Monday.

THE ANGLO-HIBERNIAN RAILWAYS.—It is asserted that the commissioners appointed by government to investigate and report upon the best line of communication between London and Dublin will, within the next month, send in their Report, which is in favour of the route by Chester and Holyhead in preference of that by Shrewsbury and Port Dynllaen. This railroad from Chester to Holyhead (of which Mr. George Stephenson is the engineer), if ever finished, will be 82 miles in length; the first 30 of it will be almost a dead level, and will skirt the coast of Wales for that distance. The engineering difficulties on the subsequent part of the line are by no means of as formidable a character as might have been anticipated, and are certainly not greater, if so great, as those which have been successfully contended against on the London and Birmingham, and the Manchester and Leeds lines. The great point at issue was the risk of crossing the Menai bridge. Independent of the dangers of suffering so much as eighty to one hundred tons—the average weight of a train—being on it, in rapid transit, it is well known that the vibration of a suspension bridge impedes the action of the locomotive, and that there is, consequently an immense loss of power. To obviate this, as well as the danger, I believe the Commissioners will recommend the granting permission to the Company to transmit one or two carriages at a time, by means of a stationary engine, the weight on the bridge at any one time not to exceed about ten tons.

DOCKS ON THE MERSEY.—The corporation of Liverpool have recently bought a large extent of ground on the Birkenhead side of the Mersey, close to the two principal ferries opposite to Liverpool; and in consequence of the bed of the river lying on the Chester side, they are about to construct docks, which will be accessible to almost all states of the tides, and from whence it is probable that the Irish mail steamers will start. The railway will run as close to the water's edge as the Kingstown Railway does to the harbour, and the transference of the mails, passengers, &c., will not occupy more than ten minutes instead of, as at present, nearly three quarters of an hour.

DRAWBRIDGE OVER THE OUSE AT SELBY.—This structure, so important to the completion of the line of the Hull and Selby Railway, is now steadily proceeding, and, as its form and principle become more and more apparent to the public eye, its fitness and suitability are at the same time equally demonstrated. When finished it will present a beautiful specimen of cast iron bridge building. The main arch and the abutments

on the north side of the river are already completed. Great credit is due to the architect and the contractor for having surmounted so effectually, in the structure of this edifice, the formidable obstacles that presented themselves from the first to this great undertaking. Deep, and we trust, lasting foundations have been laid in the very centre of the river. Upon these cast-iron piers have been successfully planted, and now sustain a bridge of the same material of handsome design and dimensions. It is a fine and gratifying exhibition of the triumphs of science to behold the ease with which two men on each side of the immense arch unfold its ponderous "leaves" when necessary, and the cabinet-like exactness that these same "leaves" display when lowered again into their place. But this to be fully felt and admired should be seen.—*Leeds Intelligencer.*

Colonel Sir Frederick Smith and Professor Barlow have returned from their tour of inspection of the competing lines between Lancaster and Carlisle, and, it is understood, will be ready to make their report as soon as they shall have received certain statistical returns, estimates, and other documents which they have required the promoters of these lines to supply. We have reason to believe that the commissioners are of opinion that much skill has been displayed by the engineers employed in laying down the competing lines through the difficult country with which they have to contend. Colonel Cunningham has been obliged to retire from the Commission in consequence of ill health.—*Railway Times.*

Chester and Birkenhead Railway.—The principal structure on this line is the viaduct over the Ellesmere and Chester Canal at Moston, which consists of eleven arches; the centre one is a skew arch, at an angle of forty-eight degrees with the line of the canal. The crown of the arch is thirty-six feet above the surface of the water in the canal, and measures fifty-two feet in span. The other ten land arches are twenty feet span, and the highest is forty-four feet above the level of the ground.—*Liverpool Chronicle.*

North Midland Railway.—A considerable portion of this railway is so far completed as to allow of the permanent way being laid: this is done on the greater part of the line. The most forward district is that situated between Derby and Barnsley. One line of rails is now nearly all laid for the whole distance, which is about 50 miles, great exertions having been made to accomplish this, as it is expected the directors will pass along the line with a locomotive engine, between the towns of Derby and Barnsley, very shortly—probably next week. In the neighbourhood of Belper, Clay Cross, Staveley, &c., the works are proceeding night and day, in order to have a road through the large excavations in those districts. The first-class stations are nearly all contracted for, and several of them are in a forward state. The Eckington one is nearly ready for the roof; the Chesterfield and Southwingfield stations are also far advanced; the Leeds and Sheffield stations have been set out during the week. The latter one is contracted for by Mr. Crawshaw, and will be situated near the entrance of the Sheffield and Rotherham railway. It will be a large and convenient station; the cost is estimated at about £8,000.—*Sheffield Iris.*

Calais Harbour.—The French Government, having in contemplation a railroad communication between Paris and the metropolis of this country, have commenced considerable improvements in the port of Calais, by constructing a new floating basin for the accommodation of shipping, and by forming a large reservoir to be filled at high water for deepening the entrance of the harbour. This is the more important, as competent parties, after a mature consideration of the situation of the three ports of Boulogne, Dunkirk, and Calais, have asserted that, even supposing the line of railway to be complete, the communication between London and Paris could not be made regular, unless the ports of Dover and Calais were so improved as to be accessible in every state of the tide.

Llanelly Railway.—This undertaking is fast progressing to the mineral district. The line is entirely completed from the new docks, Llanelly, to Cross Inn, and the branch thence to Cwm Ammon is in a forward state, though as yet no produce has been brought down the line. The off-branch to the Cwm Ammon Colliery is in course of formation, and in a few weeks will be finished; and the main branch is completed beyond Gors-y-Garnant Colliery. The Aberlash branch, too, is in a forward state; a very substantial wooden bridge is erected over the river above Duff-yn-lodge, and the whole of the levelling to Cottage-hall will be completed in two months at farthest—the Aberlash and Plasbach cuts being the only heavy work remaining. We do not understand, however, that there are any works opening on this branch; but, when it is completed to Mynydd-mawr Collieries—which we expect to find will be the case in September at farthest, a considerable traffic is expected down the line. There is to be an incline above Cottage-hall, to reach the summit level, after which the branch will run nearly on a dead level, and without any material cutting or filling. We hear that the late wet season considerably retarded the progress of the work on this line, or some produce would ere this have been brought down; but in a short time it is expected that a very large supply of anthracite will be poured into the market from the Cwm Ammon district, and that the autumn will complete the communication to the Mynydd-mawr Collieries. We do not see any sign of smelting iron on this line, so that the main dependence of the railway will be on coal traffic. The entire line is marked out to Llandilo, but not yet commenced upon.—*Cambrian.*

Thames Tunnel.—The proprietors in this undertaking held their annual meeting during the month. It was stated in the directors' report, that the sum expended was £363,000., and that the undertaking would be completed for less than £500,000. The progress during the year had been 245 feet, and the work was now within 60 feet of the wharf wall at Wapping. In 1838, 24,000 persons visited the tunnel; and last year 34,000 paid for admission.

The *Venice Gazette* announces that an important work, which will be of great benefit to the navigation and commerce of that city, is about to be undertaken. It will consist of an immense mole of white marble to the north of the Lido di Malmocco, which will prevent that part of the port from being choked up by sand now constantly washing in from the sea. At the head of this great enterprise are Messrs. Tulacchini and de Bruck.

Port of Bristol.—A meeting took place at the beginning of the month, at the British Coffee-house, Cockspur-street, for the purpose of initiatory measures relative to the formation of a new pier and breakwater at Portishead, near the entrance to the Avon (a full account of which has appeared in our present and previous number), which will obviate the delays and inconveniences attending the navigation of that river. Mr. Baron, M.P., Mr. Beamish, M.P., and other gentlemen of influence, take interest in the enterprise, which appears of great importance to the communication with Ireland especially. It is intended to connect the pier with the Great Western Railway.

Dublin Bay.—At a recent meeting of the Royal Dublin Society, Mr. Beaumont read a statement of an interesting plan for the improvement of the port of Dublin, and for deepening the bar and shoals of the bay, the grand nature of which is insulating the Hill of Howth, by cutting a channel through the peninsula at Sutton, by which he confidently expects that great bar and hinderance to Dublin becoming a great and commercial port will be removed. He brought forward the opinions of many eminent civil engineers in support of his own opinion; he calculated the expense at 300,000*l.*; and if so great an improvement could be accomplished for so small a sum, his project would be an incalculable benefit at a very small expense. [This magnificent project, we believe, originated with Mr. Hyde Clarke, C. E., but to whomsoever the credit of it may be due, we consider it to be one of the very finest projects ever brought forward for benefiting Ireland.—Con.]

Portsmouth.—The floating bridge, which will shortly be opened, is 70 feet in length, and 60 in breadth, and is capable of holding on each side, besides passengers, two rows of carriages 70 feet long; she is impelled by two engines of 20 horse power each, the cylinders being 18 inches in diameter, and the length of the stroke 3 feet. The average rate of the engines will be about 30 strokes per minute, and the average speed about 350 feet per minute; so that she will perform the passage (2,200 feet) in about 7 minutes. She only draws, with all her machinery on board, 2 feet 9 inches, and 50 tons additional weight will only sink her 4 inches.

Southampton Docks.—The tidal dock now in progress will be completed this year, and Southampton will become the station for the West India mail steamers.

Lighthouses are to be immediately erected on Roanharick rock, Berehaven, and St. John's Point, Downshire.

St. Phillip's Bridge, Bristol.—A caissoon, containing part of the foundation of one of the centre arches of St. Phillip's bridge, was launched a few days since. The size of this vessel is 45 feet long by 24 feet wide, and 22 feet in depth, and it contained, when launched, three feet of foundation, or 140 tons of stone. Great credit is due to the contractor, Mr. Broomhead, for the superior manner in which the launch was effected, although the water was not to the height required by 2 feet. We understand that a second caissoon will be immediately laid down on the "ways."

Glasgow, Paisley, Kilmarnock, and Ayr Railway.—This railway, which passes through one of the most important manufacturing, coal, agricultural, and grazing districts in Scotland, is in a very flourishing state. The Shareholders had a meeting on the 24th of February last, at which, the report of the directors, and also those of Mr. Miller and Mr. Evrington, were read, and afforded much satisfaction to the meeting: 342,145*l.* have been paid upon the shares; and, 75,870*l.* have been borrowed upon the security of the railway. It was stated that the road, and its stations, between Ayr and Irving, and at Monkton and Froom were nearly ready for the accommodation of the public; but the deep cutting near Kilwinning had retarded that part of the line, though that was also progressing favourably. Between Kilwinning and Dalry, and thence to Kilbernie Loch, near Beith, there is also heavy cutting: and some difficulties had to be encountered in passing the boggy grounds near Muisburn. The bog there is 45 feet

deep in some places, and as this kind of soil is not adapted for even the bottom of a railway, the contractors require much labour and care, and the work, consequently, proceeds more slowly than if the ground were better. There is much heavy cutting along the whole line, from Kilwinning to Paisley; but Mr. Miller reports favourably of its progress, and mentions that the mason work is all complete, which gives him reason to hope that the entire line would be open in the summer, or early in the autumn. This line of railway, through a country in which there is a great deal of traffic, where the roads are hilly, and where canals are out of the question, cannot fail in being of great ultimate advantage to the public; and it gives us great pleasure to state that the most influential noblemen and gentlemen in the district through which it passes take a warm interest in its promotion. Their example is worthy of being generally followed; and we may add, that if half the time and talent which the influential classes in this country used to spend upon mere political bickerings which were profitable to nobody, the parties would benefit themselves and the public, be gratified by well-earned applause while they lived, and held in revered memorial after they yielded to the common fate of human beings.

RECORD OF PUBLIC BUILDINGS.

ROYAL EXCHANGE.—In our last Number we stated that Mr. Cockeril and Mr. Tite were not competing with each other for the New Royal Exchange. But we are happy to say that the correspondent who forwarded the paragraph was in error, and that each of the above named gentlemen are actively engaged in preparing designs.

CARRARA MARBLE.—Nearly all the persons employed in these marble works have been for a long time past, engaged in preparing marble for a magnificent marble hall, to be constructed in the winter palace at St. Petersburgh. Two large vessels laden with marble, already prepared by sculptors, architects, &c., have reached their destination. It is expected that the whole will be completed this spring—three other vessels being on the point of departure. The estimated expense of this colossal hall, which is be to completely lined with the finest Carrara marble, amounts to two millions of rubles.

GREAT GEORGE-STREET CHAPEL, LIVERPOOL.—We hear, with very great pleasure, that the subscription towards the erection of a new chapel on the site of the old, now amounts to nearly the sum of £5,500, which, with a moiety of the insurance money, makes a total not far short of £7,500. A Building Committee has been formed, and no time will be lost in obtaining plans and estimates for the new edifice. The building will scarcely be ready for occupation before this time next year.

THE NEW HOUSES OF PARLIAMENT.—The workmen, of whom there are 200, are now employed in completing the foundations for the projected mansion for the Speaker, the house for the Usher of the Black Rod, the select committee-rooms, libraries of the two houses, and other offices. It is understood that the foundation stone for both the new houses will be laid by Her Majesty in person, with great pomp, in the course of the approaching summer, if the state of the works, which advance but slowly, will admit of the ceremony taking place so early.

NEW WESLEYAN CHAPEL, AT HULL.—Kingston chapel, of which the first stone was laid on the 16th inst., will be not only the largest, but the most handsome, and also most pleasantly situated of all the Wesleyan chapels in Hull. The ground purchased for the chapel and other erections, is nearly two acres, having frontages both to Holderness-road and to Pemberton-street. The chapel itself will cover 700 square yards, will be 90 feet long by 70 feet wide, and 45 in height. The south front will be embellished by a splendid portico, with four Corinthian columns and a pediment, all of the same form, but larger, than those at the principal entrance to the Public Rooms, and approached by a flight of seven steps. There will be five windows abreast in this front, which will be entirely of stone; the sides will be of white brick, faced with stone, and will each have seven windows abreast and two in height, besides the gratings which will admit air and light to vaults beneath the chapel. The internal arrangements will be very commodious, and in a style of comfort unequalled. The building will be heated with hot water. Sittings will be provided for 1600 persons; about one-fourth of which will be free.

NEWRY UNION WORKHOUSE.—The first stone of this building was laid during the past month. Although called the first stone, it is (technically speaking) the quoin stone of the plinth of the principal entrance. The basement part of the building and of the offices connected therewith, is now above the surface. The structure is to be of the Tudor style of architecture, and will, with the yards, cover upwards of five statute acres.

THE INDEPENDENT COLLEGE, MANCHESTER.—The premiums offered for the first and second best design for this building have been awarded to Mr. Irwin and Mr. Lane—that for the first being 100 guineas, and for the second 50 guineas; about twenty-five of the designs sent in, including those selected, were exhibited by the Architectural Society of Manchester, and the general feeling appeared to be that the decision was judicious. The majority of the designs sent in were of an inferior character—but the specified sum for completing the building, 12,000*l.*, was very insufficient, considering the required accommodation.

MISCELLANEOUS.

PNEUMATIC MIRROR.—The attention of the Royal Institution was called to a new process for converting plate glass into convex and concave mirrors, by a most simple process. An iron case being provided, a circular plate of glass is fixed into it and made perfectly air tight, leaving a chamber at the back full of common air. By drawing out that air, either with an air pump or the mouth, the pressure of the atmosphere on its surface immediately converts it into a concave, while blowing more air into the chamber makes the glass assume a perfect convex mirror. Mr. Naysmith originally brought this subject before the Birmingham Association, and explained the process last Friday, at the Royal Institution.

SURVEY OF IRELAND.—The survey of twenty-four counties is finished, viz.—Londonderry, Antrim, Tyrone, Down, Fermanagh, Monaghan, Louth, Donegal, Cavan, Armagh, Meath, Leitrim, Longford, Dublin, Sligo, Roscommon, Westmeath, Kildare, King's County, Mayo, Wicklow, Galway, Carlow, and Queen's County; of which nineteen are published, and the remaining five in progress of engraving The survey of six counties are in progress;—Clare, Kilkenny, Wexford, Limerick, Tipperary, and Waterford.

NEW THRASHING MACHINE.—At the Isle of Wight agricultural meeting, lately, a hand thrashing machine, worked by two strong lads, and capable of thrashing a load of corn per day, was exhibited by Mr. Barnabas Urry, jun., the inventor. The little machine excited considerable curiosity amongst the farmers, and thrashed out a sheaf of corn per minute on the spot with the greatest regularity, and seemed admirably adapted for a small farm. The price (about £14) will enable small occupiers to avail themselves of its assistance.

THE LIVERPOOL.—This steam-ship has been for some time "discharging" her engines, and boilers, and machinery, and, we may add, her paddle-boxes, and all the deck encumbrances, preparatory to her going into one of the graving docks to be thoroughly overhauled and widened. Her breadth will be increased seven feet; and she will then float lighter. New boilers are also made for her, on an improved principle; and these, we learn, will occupy less room and be much lighter than those hitherto used. The "Liverpool" will have a spare deck, like the "United States;" and will be ready for sea by the end of May. —*Liverpool Paper.*

IN consequence of the neglect of some persons employed at the Pentwyn ironworks, near Ponty-pool, to watch the steam-boiler, the wheels went round with irresistible fury, destroying a considerable part of the machinery, by which 300 men are thrown out of employ for six weeks. [The machinery at these works must have truly been in a primitive state for such an accident to have occurred.—CON.]

LIST OF PATENTS GRANTED DURING MARCH.

James Beaumont Neilson, of Glasgow, gentleman, for certain improved methods of coating iron under various circumstances, to prevent, oxidation or corrosion and for other purposes.—Sealed 29th February.—six months for enrolment.

Rowland Macdonald Stephenson, of Upper Thames-street, London, engineer, for an improved method or methods of adjusting, shifting and working theatrical scenery and apparatus.—Sealed 29th February—six months for enrolment.

Richard Edwards, of Fairfield-place, Bow, dealer in emery cloth, for improvements in preparing and combining of materials, used in lighting or kindling fires.—Sealed 29th February—six months for enrolment.

John Sylvester, of Great Russell-street, engineer, for improvements in the construction of doors and frames; for closing the openings of fire places, ash pits, flues, chimnies, and certain retorts.—Sealed 3rd March—six months for enrolment.

Joseph Shore, of Birmingham, merchant, for improvements in preserving and covering certain metals and alloys of metals.—Sealed 3rd March—six months for enrolment.

James Horne, of Clapham Common, Esq., for improvements in the stuffing boxes of lift pumps. Sealed 3rd March—six months for inrolment.

Joseph Clisild Daniell, of Limpley Stoke, Wilts, for an improved method of preparing shoot or weft, to be used in weaving woollen cloth, and cloths made of wool and other materials.—Sealed 3rd March—six months for enrolment.

John Rangeley, of Camberwell, gentleman, for improvements in the construction of railways, and in the means of applying power to propelling carriages and machinery.—Sealed 3rd March—six months for enrolment.

William Craig, of Glasgow, engineer, and William Douglas Sharp, of Stanley, Perthshire, for certain improvements in machinery for pre-

paring, spinning, and doubling cotton flax, wool and other fibrous substances.—Sealed 3rd March—six months for enrolment.

Joseph Norton, of High Bridge-mill, York, and George Collier, of Kelmanthorpe, in the same county, mechanic, for an improvement in looms for the weaving of figured and twilled fabrics.—Sealed 4th March—six months for enrolment.

Joseph Bower, of Hunslet, York, soda ash manufacturer, for certain improvements in the manufacture of carbonate of soda.—Sealed 4th March—six months for enrolment.

Charles Alexander Pellerin, of Leicester-square, gentleman, for improvements in wind and stringed musical instruments, being a communication—Sealed 4th March—six months for enrolment.

Charles Kober, of Leadenhall-street, London, cloth manufacturer, for improvements in fixing colour in cloth.—Sealed 7th March—six months for enrolment.

Caroline Julia Sophia Cox, of Addison-road, Kensington, spinster, for an improved mode of fastening and uniting the edges of the divided parts of shoes, boots, bandages, packages, and other articles of dress or utility.—Sealed 7th March—two months for enrolment.

Joseph Atkinson, of Round-hill, near Marsham, York, farmer, for improvements in thrashing and winnowing machines.—Sealed 7th March—six months for enrolment.

Robert Molyneux, of Southampton-row, Middlesex, chronometer maker, for an improvement or improvements in chronometers.—Sealed 7th March—six months for enrolment.

William Maltby, jun., of Mile-end, chemist, and Richard Cuerton, jun., of Percy-street, brass-founder, for improvements in extracting and concentrating the colour, tannin, and other matter contained in vegetable and animal substances.—Sealed 7th March—six months for enrolment.

Luke Herbert, of Birmingham, civil engineer, for improvements in the manufacture of coffered spades and shovels, sowing and grafting tools, and other implements of a like nature, being a communication.—Sealed 7th March—six months for enrolment.

Hayward Tyler, of Milton-street, Cripplegate, engineer, for certain improvements in machinery, or apparatus for impregnating liquids with gas, including bottles for retaining, keeping, and preserving liquids so impregnated, also in the manner of filling and closing such bottles.—Sealed 7th March—six months for enrolment.

James Knowles, of Little Bolton, Lancaster, coal-merchant, for an improved arrangement of apparatus for regulating the supply of water to steam boilers.—Sealed 10th March—four months for enrolment.

George Gwynne, of Portland terrace, Regents park, gentleman, for improvements in the manufacture of candles, and in operating upon oils and fats.—Sealed 10th March—six months for enrolment.

William Forrester, residing at Barrhead, Renfrew, manager, for certain improvements in sizing, starching, dressing, and otherwise preparing warps for weaving fabrics, and on the machinery and apparatus therewith connected.—Sealed 11th March—six months for enrolment.

Thomas Peet, of Bread-street, Cheapside, gentleman, for certain improvements in steam engines, being a communication.—Sealed 11th March—six months for enrolment.

Richard Smith and Richard Hacking, both of Bury, Lancaster, machine makers, for certain improvements in machinery or apparatus for drawing, stubbing, roving, and spinning cotton, wool, flax, silk, and other fibrous substances.—Sealed 13th March—six months for enrolment.

Eteinne Robert Gaubert of Paris, professor of mathematics, for certain improvements in machinery or apparatus for distributing types or other typographical characters into proper receptacles, and placing the same in order for setting up, after being used in printing.—Sealed 13th March—six months for enrolment.

James Hadden Young, of Lille, in the kingdom of France, merchant, and Adrien Delcambre, of Lille aforesaid, manufacturer, for an improved mode of setting up printing types.—Sealed 13th March.

Robert Varieas, of Burton-crescent, surgeon, for improvements in rendering fabrics and leather waterproof.—Sealed 16th March—six months for enrolment.

William Crofts, of Radford, Nottingham, machine maker, for improvements in machinery, for the purpose of making figured or ornamented bobbin, net, or twist lace, and other ornamental fabrics, looped or woven.—Sealed 16th March—six months for enrolment.

Jean Francois Victor Fabien, of King William-street, London, for improvements in rotary engines, to be worked by steam or other fluids.—Sealed 16th March—six months for enrolment.

Thomas Craddock, of Broadheath, Radnor, farmer, for a certain improvement or improvements in steam-engines and steam-boilers.—Sealed 16th March—six months for enrolment.

Richard Smith, and Richard Hacking, of Bury, Lancaster, machine makers, for certain improvements in machinery, for spinning cotton and other fibrous substances.—Sealed 16th March—six months for enrolment.

Isham Baggs, of Cheltenham, gentleman, for improvements in engraving, which improvements are applicable to lithography.—Sealed 17th March.—six months for enrolment.

Moses Poole, of Lincoln's-inn, gentleman, for improvements in producing and preparing leys for soap making, and in the manufacture of soap, being a communication.—Sealed 17th March—six months for enrolment.

Samuel Seaward, of the canal iron works, Poplar, engineer, for certain improvements in the construction of steam engines, and in the application of steam engines to propelling ships and other vessels.—Sealed 17th March—six months for enrolment.

Sir William Burnett, of Somerset-house, knight commander of the royal Hanovarian Guelphic order, for improvements in preserving animal, woollen, and other fibrous substances from decay.—Sealed 17th March—six months for enrolment.

John Jackson, of Manchester, nail and bolt manufacturer, for certain improvements in the manufacture of nails, nuts, bolts, and rivets.—Sealed 17th March—six months for enrolment.

Thomas Sterling, of Limehouse, patentee of the "Rapid" filterer, for improvements in the manufacture of fuel.—Sealed 20th March—six months for enrolment.

Francis William Gerish, of East-road, City-road, patent hinge maker for improvements in locks and keys, and in other fastenings for doors, drawers, and other such purposes.—Sealed 20th March—six months for enrolment.

Charles Keine, of Sussex-place, Regent's-park, gentleman, for improvements in producing surfaces on leather and fabrics, being a communication.—Sealed 23rd March—six months for enrolment.

William Newton, of Chancery-lane, civil engineer, for certain improvements in the strengthening and preserving of ligneous and other textile substances, being a communication.—Sealed 23rd March—six months for enrolment.

Samuel Hill, of Sloane-street Chelsea, gentleman, for improvements in the making of bread and biscuit.—Sealed 25th March—six months for enrolment.

Elhanan Bicknell, of Newington-butts, merchant, for improvements in separating the solid from the liquid parts of tallow, and other fatty matters, being a communication.—Sealed 25th March—six months for enrolment.

William Palmer, of Sutton-street, Clerkenwell, candle-maker, for improvements in the manufacture of candles, and in apparatus for applying light.—Sealed 25th March—six months for enrolment.

Henry Smith, of Birmingham, lamp manufacturer, for improvements in gas-burners, and in lamps.—Sealed 25th March—six months for enrolment.

George Richards Elkington, and Henry Elkington, of Birmingham, for improvements in coating, covering, or plating certain metals.—Sealed 25th March—six months for enrolment.

Joseph Crossfield, of Warrington, soap maker, for certain improvements in the manufacture of plate glass.—Sealed 25th March—six months for enrolment.

Samuel Knight, of Woodhouse-mills, Lancaster, bleacher, for certain improvements in machinery, or apparatus for boiling, bleaching, or scouring, for the purpose of preparing and assisting the process of bleaching and dying cotton, and linen, and other fabrics and fibrous substances—Sealed 25th March—six months for enrolment.

James Hay, of Belton, Scotland, captain in the Royal Navy, for an improved plough, which he entitles the Belton plough.—Sealed 25th March—six months for enrolment.

Henry Philip Roquette, of Norfolk-street, Strand, merchant, for a new pigment, being a communication.—Sealed 25th March—Four months for enrolment.

James Sabberton, of Great Pulteney-street, Golden-square, tailor, for a fastening to attach straps to the bottoms of trowsers.—Sealed 26th March—two months for enrolment.

Alexander Southwood, Stocher, of Birmingham, manufacturer for certain improvements in manufacturing tubing or tubes, which are applicable to gas and other purposes.—Sealed 27th March—six months for enrolment.

Richard Prosser, of Cherry-street, Birmingham, civil engineer, for certain improvements in machinery or apparatus for manufacturing pipes.—Sealed 27th March.

Henry Kirk, of Upper Norton-street, Portland-place, merchant, for improvements in the application of a substance or composition as a substitute for ice for skating and sliding purposes, part of which improvements may also be employed in the manufacture of Ornamental slabs and mouldings.—Sealed 28th March—six months for enrolment.

John Bethell, of Saint Johns Hill, Wandsworth, gentleman, for improvements in treating and preparing certain oils and fatty matters.—Sealed 27th March—six months for enrolment.

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